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SUBWAY WORK.

Although it is a branch of the art that does not attract much attention unless people see a big thoroughfare torn up by its roots for a new underrunning trolley system, subway construction is going on steadily all the time in various parts of the country, and large expenditures often attend or depend upon the operation. Thus the City of Providence has been equipped very quietly by the Narragansett Electric Lighting Company with an extensive new system, parts of which still remain to be carried out, and at Syracuse, Lieut. J. B. Cahoon has been entrusted with the execution of important plans contingent upon the use of the subways built but not yet filled, by the Syracuse Underground Wire Company. There are other large cities where the overhead wires are noticeably redundant, but the tendency to bury the electric light wires is now well developed, and the growing success of underrunning trolleys will aid in the development of comprehensive plans for general subway construction wherever the density of population is such as to warrant putting the wires underground.

ELECTRIC VALVES.

It is well known that the discharge through a vacuum tube is practically unidirectional in character, the e. m. f. at "make" usually not being sufficient to cause a discharge through the high resistance in circuit. By a combination of several Crookes tubes the inverse wave may be entirely suppressed, which is an advantage in Röntgen ray work, resulting in much less heating at the electrodes and surface of the glass. Another means of suppressing part of an alternating current wave is by the employment of electrolytic cells, aluminum cells being particularly applicable for this purpose. In another column appears a notice of a patent, one object of which is to redress alternating currents by this means without any sparking effect. Another interesting application of the electrolytic cell described in the patent appears to be of considerable practical value, consisting in the employment of such cells to suppress sparking upon the breaking of a circuit. The electrolytic e. m. f. balances the e. m. f. of the working source at the moment of rupture, thus stopping the flow of current and consequently eliminating the cause of sparking.

THE PACIFIC CABLE.

If the latest news from Europe is correct, the British Pacific cable scheme is much nearer accomplishment, Mr. Joseph Chamberlain having announced in the House of Commons, through Mr. Brodrick, that general lines of agreement had been reached between the imperial and the colonial authorities. He added that the Eastern Telegraph Cable Company was prepared to lay a cable from South Africa to Australia without pecuniary assistance of any kind, and would on the receipt of landing rights for the new cable, reduce the Australian rate forthwith to four shillings—96 cents per word. These statements make it evident that the next great era in cable laying is about to begin and that as before English capital and enterprise are ready to play the greatest part in it. Our own necessities for a Pacific cable are obvious, and our manufacturers are ready and anxious to show what they can do, but real signs of approaching ac-

complishment such as the above are still awaited. Much will depend on the action of Congress next winter. Some day the Pacific may be as thickly strewn with cables as the Atlantic now is, but meantime the first from our shores to Asia has still to be laid, and we must continue to depend upon the kindly offices of our English cousins, who are our only possible rivals in such future work.

THE CATASTROPHE AT COMO.

The fire which on July 8th destroyed the buildings of the Volta Centenary Exposition at Como, Italy, was a catastrophe whose effects are irreparable. Though a few of the Volta relics were saved, it appears from accounts thus far received that these do not include such epoch making apparatus as the "Crown of Cups," the original electrophorus and the absolute "trap-door" electrometer, and but few of the Volta manuscripts, books and letters were rescued. The great loss is unusually regrettable from the fact that several of the articles destroyed were of intense interest as marking the earliest beginnings of the present day electrical development. Faraday's induction coil and Bell's original telephone alone have a value at all comparable. Among other articles destroyed by the fire was the original Ferraris rotary field model, which ill-fated apparatus, our readers will remember, met with a mishap on its way to the Chicago Centennial, the vessel containing it having sunk in the Harbor of Genoa. In the future those having the care of similar great relics will probably be chary in permitting their exhibition in the temporary structures of expositions, and such an attitude will be upheld by many who consider that objects of this character are too sacred in the eyes of science to be exposed to risk in order to satisfy idle public curiosity. The worshippers of electricity have no cause to pass either their forbears or their offspring through the fire.

A DISCOVERY IN ELECTRO-PHYSICS.

A few weeks ago English scientific circles were startled by a delphic utterance from Lord Kelvin in the form of a telegram to the Royal Society of Edinburgh, as follows: "For the Royal Society to-night. Magnetism and molecular rotation. An electrified body is set into rotation by the generation of a magnetic field around it. The magnet-optical phenomena discovered by Faraday, Kerr and Zeeman are to be thus explained." The current number of the London *Electrician* contains a letter from Lord Kelvin relating to this announcement, but, very strangely, it throws little further light on the subject—a full exposition apparently being reserved for presentation before the Royal Society of Edinburgh. From the letter it appears that the assertion is not founded on observation but upon mathematical deduction, and it is restated in the following terms: "An electrified ring of non-conducting matter must, by the generation of a magnetic field, be set into rotation, in one direction if positively electrified, in the other direction if negatively rectified." We are thus left in darkness as to whether the forces of rotation only exist while the magnetic field is changing. If this were the case, the rotation would, of course, be only temporary, but in the letter above quoted the statement occurs that the body "will, in virtue of its inertia, remain in rotation until the field is annulled, when the rotation will stop," which would seem to imply that the force does not depend for its continuance on variations in the magnetic field. The announcement has an extremely great interest from its implication that electrostatic forces may be set up by a magnetic field, and from promising to correlate a number of electrical phenomena that heretofore have appeared to be unique in character. It is also probable that new generalizations may be based upon the phenomenon predicted which will greatly advance electrical and molecular science. The electrical public will await with much interest a full elucidation of the discovery, the bearing of which now appears to be involved in so much uncertainty.

AUTOMOBILE ACCIDENTS.

The main argument against the use of the electric vehicle has been that if you wanted to go touring any great distance, it was hopelessly limited, don't you know, by the short range of the storage battery. If you had almost any kind of hydrocarbon carriage you could wander and whirl along at your own sweet will regardless of the length of the journey, and it would only cost you ten cents for motive power all the way from the Bowling Green to the Golden Gate. All of this is very pretty, but when you see a non-electric vehicle on its way to the Pacific Slope held up for two or three weeks within the confines of New York State, it does look as though the seductiveness of that touring argument against the electric vehicle had rather too much glamor in it. At the same time, without any desire to proclaim the superior staying qualities of the electrics, we must confess our anxiety to see more attention given to the perfection of the mechanical details common to all automobiles. The recent troubles in France from breakdowns due to racing at the rate of 20 to 30 miles an hour carry with them a warning that may well be heeded in this country, where we are far more inclined to slap-dash methods than the French are.

As for electric vehicles, the motor and the batteries are already elements of safe determination, but such mechanical features as the tires, the levers, the brakes and the steering gear have many chances for betterment, and on these we may expect to see the attention of inventors fixed. Even the motors and batteries are susceptible of lightening, and with every reduction of weight will go a greater margin of safety and a higher average of efficiency.

THE PARIS EXPOSITION AND CONGRESS.

Matters are now rapidly ripening for the Paris Exposition of 1900, and Mr. Drake, who has charge of the important departments of electricity and machinery, goes to France this week to close up some of the most essential and vital parts of his work. If there has been any one particularly striking feature of American industrial development during the past six years since the great show at Chicago in 1893, it has been the conquest of foreign markets by American tools and apparatus, and the space now to be occupied by representative exporting concerns—some 60,000 to 75,000 square feet—is none too much for such an opportunity as Paris will present next year. It is a curious fact, and somewhat of an anomaly, that the main check on the American exhibit under Mr. Drake's care will be the degree to which large concerns from this country have begun to manufacture on the other side of the Atlantic; but even if the goods shown are the product of the old world they will still bear the hall mark of American genius and inventiveness. To-day, the locale of production has largely narrowed itself down to a question of freights, and next to this limitation comes the natural prejudice in favor of an article that is made on one's own native soil. Trade follows the flag and the cheapest freights.

Aside from the purely industrial side of the exposition and its aid in introducing producers to consumers, is the technical and theoretical side of the arts and sciences, and here the professional man must depend largely upon his own efforts. When we state that there are about 120 congresses to be held in connection with the exhibition, it will be seen at once that it would be foolish for Commissioner General Peck to try—or for any other official authority to attempt—any official control of so many enterprising legislatures. So far as the Electrical Congress is concerned, we are glad to note that our French brethren of the Sociétié Internationale des Electriciens have already taken the subject up and have organized a powerful committee to provide plan and scope for the work. It is none too early to define what the congress should do, and we are glad to know that a movement is already on foot to secure contemporaneous meetings of American,

English, German, Austrian and other national electrical bodies. The congress is timed for the third week in August, so that barely a year is left in which to formulate plans, arrange the work, name the delegates and committees and secure the official approval and co-operation which do so much to secure recognition for new units, rules and standards.

THE NEW YORK TROLLEY STRIKE.

There probably has seldom been a metropolitan strike which soared at the outset so buoyantly with prediction, and which collapsed so quickly, as the recent strike of motormen and conductors on the street railways of Greater New York. The men declared that their hours of duty were illegal, and sought a higher pay on the basis of this alleged illegality. If, however, their claim was just, it would manifestly be more to their advantage to seek means of obtaining legal redress, than to stir up the lawless elements of the city under the plea of a strike. It is difficult to understand in what manner lawlessness can aid any cause in a matter of law. The reason for the prompt failure of the strike appears to have been that the police took swift measures to check intimidation and rioting, so that the strikers' places were readily filled with men who were willing to accept the rejected labor and wage. The fact should be apparent that the men are scarcely within the ranks of skilled labor. Their duties indeed call for many good qualities, but for very little skill or knowledge. Consequently they are unfortunately always in competition with nearly the whole unemployed labor market.

The replacement of the steam engine by the electric motor for urban or suburban traffic is apparently destined to bring about a similar result. Owing to the simplicity of the electric motor, much less skill is required to operate it than to operate a steam engine. Consequently we must expect that the change will tend to depress the wages of the motormen and to reduce the chance of success in strikes made for the rate of steam labor. It would, however, be a mistake to suppose that the general introduction of electricity into the industrial arts is destined to reduce wages. On the contrary, we think that the evidences clearly point to the opposite conclusion. The increased facilities for production brought about by the electrical distribution of power tend to increase the pay of skilled labor. Moreover, many processes have become, and are daily becoming, possible through electrical means, that would otherwise be either physically or commercially impossible, and the skilled labor released from the engine is naturally directed to these occupations.

In spite of occasional disturbances of labor, and temporary discouragement, we must either admit that the whole fabric of civilized institutions is a failure, or else confess that every new electrical machine and labor-saving device is a blessing in disguise both to the worker and the worked for. There is no middle course possible either for belief or for procedure. We want more electric machines that will pay to make and pay to use, and still more. We also want to see fewer strikes made rashly and with uncounted cost, for such misguided action only adds to the burden it is sought to lessen.

SIMPLIFYING ELECTRICAL UNITS.

An interesting paper by Professor A. Blondel appears in this issue upon the subject of simplifying the perplexing relations which exist at the present time between the fundamental C. G. S. units and their derivatives the practical units of the ohm, volt and ampere type. The practical men are satisfied with the practical system, and the theoretical men are satisfied with the C. G. S. system. But the theoretical man rebels at having to learn the practical units when he first learns to become practical, and the practical man eschews the C. G. S. units which he does not understand. Consequently between the representatives and the requirements of theory and practice a great gulf is fixed for which there is neither excuse nor necessity. The more the matter is inquired into, the more evident it seems that there never was any need for the practical system, and that the fundamental C. G. S. system alone would have been amply sufficient for all the requirements both of theoreticians and of practicians, besides avoiding the mystery and saving the labor of the dual system.

M. Blondel's suggestions are entirely in accordance with the views expressed in our editorial columns of June 10 last, and are to the effect that it is most desirable to christen the C. G. S. units, and to give names to a limited number of prefixes representing decimal multiples and submultiples. The object of such a procedure would be to enable the students of electrotechnics in future to employ the C. G. S. system as a practical system, equally with the existing practical system, so that, in the course of time, the latter may be dropped by general consent as an unnecessary encumbrance. We think that M. Blondel's suggestion to denominate the C. G. S. electrical units by the names of the corresponding practical units, prefixing the letters "ne-," or "neo," by way of distinction, is a happy one. While it would have the disadvantage of making some of the C. G. S. names four syllables in length, yet it would have the great advantages of requiring no new names to be invented, of requiring no new names to be learned, and of saving the names of eminent electricians from being dissociated in time from the science and art in which they were pioneers. The C. G. S. unit of resistance would thus become the "neohm," the C. G. S. unit of e. m. f. the "neovolt," the C. G. S. unit of current the "neampere," and so on. This would be so simple a system to adopt that it would call for neither effort to remember, nor necessity to explain.

We are inclined to differ from M. Blondel, however, upon his suggestion of revaluing the prefixes "mega" and "micro." We think that the alteration in their numerical valuation would give rise to considerable confusion, and we would advocate leaving their values unchanged, with the adoption by general agreement, of a complete table of prefix powers of ten, say to the twentieth positive and negative powers inclusive. Up to the present time we have employed the Greek language for the ascending powers "deka," "hekto-" and "kilo-," and the Latin language for the descending powers "deci-," "centi-" and "milli." Since all these prefixes are in very extended use, it would seem to be desirable to retain this plan in extending it both upwards and downwards. Such an extension is badly needed in all the exact sciences. A scientific language cannot indeed be complete without such a system of prefix terminology. In this matter of numerical prefix terminology our modern languages are no further advanced to-day than is the arithmetic of those primitive races whose addition table is said to be comprised within the following compass: "One, two, three, — many!" When we reach the limit of the third positive or negative power of ten, language at present fails us, and we are compelled to resort to symbols. This is a disgrace to civilized language which a properly qualified and accredited international committee could readily efface.

Once the desirability of promoting the practical use of the C. G. S. system among electricians is recognized, the only outstanding questions are those of nomenclature, and are capable of speedy settlement by an international electrical congress. It has been declared that some electricians are firmly opposed to providing names for any C. G. S. unit. If this is true, we trust that they will be consistent, and never make use of the terms "metre," "gramme" and "second;" or, at least, that they will apologize for so doing at each offence.

The Madison Square, New York, New Bell Telephone Exchange.

The New York Telephone Company, in its efforts to keep pace with the extraordinarily rapid development of the telephone system of this city, is dotting the Borough of Manhattan with a group of smaller reproductions of the handsome telephone building at 15 Dey Street. One of these new telephone buildings was put in service at the beginning of the year and serves an entirely new district, called Riverside, taken partly from the Columbus district and partly from that of the Harlem Exchange. The second to be completed started off most auspiciously in the second week of this month. It is situated at 30 East 29th Street, a few doors east of Madison Avenue, and the name given to it, in according with the sensible policy of using geographical names instead of the numbered streets for the newer exchanges, is "Madison Square." The district served by the Madison Square exchange is bounded on the east by the river, on the south by 24th Street to Seventh Avenue, from which point the boundary line runs up Seventh Avenue to West 33d Street, along West 33d Street to Fifth Avenue, up Fifth Avenue to 37th Street and along East 37th Street to the river, thus leaving the Waldorf-Astoria still within the 38th Street exchange district.

The new district is taken partly from that of 38th Street and partly from that of 18th Street, and those two exchanges have been relieved of 1125 subscribers' lines, with which comfortable number the new exchange started business on the afternoon of Saturday, July 8. The transfer was carried out in the usual smooth manner, and the service was taken up at the new switchboard without a hitch of any sort. But for the change of numbers and the different style of equipment, the subscribers transferrred would have had no knowledge that the exchange ends of their lines had been expeditiously moved to a new anchorage.

The new exchange is equipped with the relay system, that dernier mot of telephone exchange equipment which smoothes out the operating at both ends of the line so remarkably. The subscriber calls by simply taking the receiver off the hook and a tiny signal lamp, placed immediately under the answering jack, gleams at the operator until she extinguishes it by inserting a plug into the answering jack. At the same time a pilot lamp in the upper part of the board also lights up and serves as an appeal to the supervisor should the operator fail to notice the gleam of the line signal promptly. The pilot lamp and the signal lamp go out together when the plug is in the answering jack. The clearing-out signal is given by the subscriber replacing his telephone on the hook. This causes a lamp set in the keyboard, opposite the cord, to light up. There is a lamp for each cord, consequently a disconnection signal for each of the two lines connected. If one lamp gleams and the other stays dark the operator knows that one subscriber is "holding the line." If both lamps stay dark she knows that conversation is going on, or at any rate that the lines are still in use. When both lamps light up she knows that both subscribers have hung up and that she may disconnect without listening in or making inquiry. The incoming trunk lines are equipped with lamps that answer the same ends as those on the local subscribers' lines.

The operation of the relay board is very pretty to watch. The rapid twinkling of the lamps as they light up and are promptly extinguished by the execution of the orders they convey, the swift motions of the operators, accompanied by very little talking, for the lamps do practically all the supervising, give the impression of a very accurate and noiseless machine with just a touch of magic and mystery that lends a fascination absent from the older style of switchboard with its clicking and chattering drops.

The Madison Square switchboard has a present equipment of 2400 subscribers' lines, almost half of which is already in use, and an ultimate capacity of 4900 lines. The operating room is on the top floor, and, occupying the entire floor, is well lighted and ventilated by windows front and back and a spacious skylight in the centre. The other floors of the building are occupied by the usual well-arranged operators' quarters and by the power and relay plant for the operation of the switchboard. The new exchange will be followed by two other model exchanges on the relay system during the latter part of the year, and eventually the whole of the New York telephone system will be equipped with the smooth working relay plant.

The New York Telephone Company's system continues to increase by leaps and bounds. At present it contains in Manhattan and the Bronx over 32,000 stations. Of these, 5000 have been added during the present year. It may be confidently expected, in view of the lower schedule of rates now in force and of the growing appreciation of the usefulness of the telephone service in all situations, that this phenomenal record will be at least equaled, if not beaten, in the second half of the year.

Sale of Independent Telephone Interests in Wisconsin to the Bell.

The Wisconsin Valley Telephone Company, an independent telephone organization, which operated 1000 subscribers and 900 miles of long distance lines in northern Wisconsin, has been sold to the Wisconsin (Bell) Telephone Company at a price fixed by the Wisconsin Bell people and far below the original cost of the property, which amounted to about $200,000. Mr. L. S. Tainter, president of the independent company, one of the largest lumber merchants of Wisconsin, makes this statement in the *Eau Claire Leader*: "I have given an option," said Mr. Tainter, "to the Wisconsin Telephone Company, contingent upon turning the properties over free from embarrassments, and I now see the way to do so at an early date. There was no money in the business at the rates fixed. I felt that I had too much at stake to warrant me in continuing in a business which had at no time paid operating expenses. I was ready, therefore, to consider a proposition from the Wisconsin Telephone Company, which has resulted in the sale at a price fixed by them and the transfer to that company of all the properties. While the experience of the past 18 months has resulted in a financial loss to me, I am well satisfied to transfer the business to other hands. The business is purely a technical one, requiring the highest order of engineering ability and special training in its mechanical department, and trained supervision in all the details of management. We have learned that the maintenance charge for a term of years will not be less than 8 to 12 per cent. per annum. It was found also that our toll charges, fixed in some instances as low as 25c. for a distance of 85 miles, were entirely too low, hardly paying operating expenses and leaving nothing whatever for maintenance and dividends."

Legal Recognition of Automobiles in Cities.

Attention has been drawn to the fact, in these columns, that automobiles now have free entrance to the Chicago parks, by legal decision. In New York City, Philadelphia, Bar Harbor, Me., and some other places, the ban still applies, more or less rigidly, but steps are universally being taken to secure reasonable treatment for the new toy of fashion and the new tool of commerce. City ordinances all over the United States usually limit the speed of vehicles to eight or ten miles an hour. Automobile owners insist that while a speed of eight miles an hour is only safe with a horse, a speed of ten or fifteen miles an hour is safe with a horseless carriage. Although no report has become public that any city has made special ordinances for the automobile, it is certain that generally the ordinances are not enforced. Cleveland, O., has enforced its speed ordinances, and of late several drivers of automobiles in New York have been arrested. Admittance to parks has been specially granted and specially refused to horseless carriages in many instances. Prospect Park, Brooklyn, and Riverside Drive, New York City, are open, but Central Park, despite protests, is closed. Citizens of Rochester, N. Y., have attempted to prohibit the use of automobiles, especially those driven by steam, unless the owners furnished bonds for indemnification in case of action for damages. The Commissioners of Delaware Park, Buffalo, N. Y., have awarded contracts for park carriages to an automobile transit company, which will use gasoline motors.

Corporation Taxes in South Carolina.

The Bell Telephone Company and other corporations have, according to press despatches, acquiesced in the valuation for taxation fixed on their property by the Railroad Board of Equalization in South Carolina. The Western Union Telegraph Company, which was taxed for $1,000,000, protested. This is the first time that these properties have been taxed in South Carolina.

Canadian Water Power Electrical Plants—V.

ISOLATED PLANT OF THE MONTREAL COTTON COMPANY AT VALLEYFIELD, QUE.

By E. M. ARCHIBALD..

OF the few isolated electrical plants in Canada, perhaps the largest and one certainly the most complete in every respect, is that installed in the Montreal Cotton Company's mills at Valleyfield, Quebec, a small city distant some 40 miles from Montreal.

Until the close of the year 1896 the entire machinery was driven direct from water power by heavy belting in long and short drives,

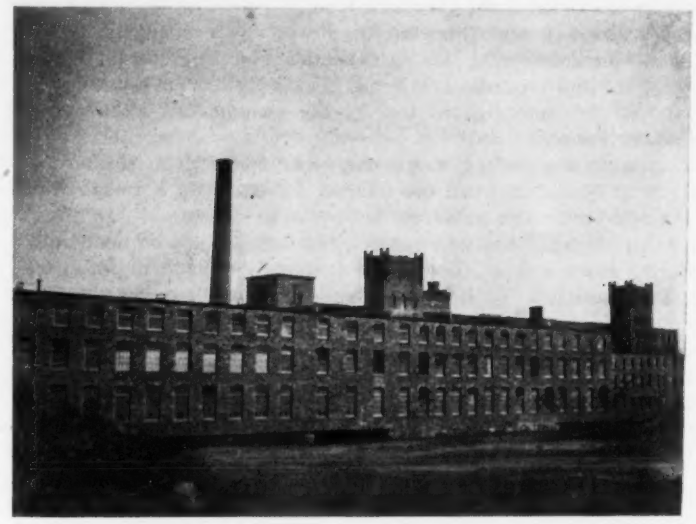


FIG. 1.—MONTREAL COTTON MILLS, VALLEYFIELD, QUEBEC.

but at that time a change was made and a new system established which, steadily growing more and more in favor, has now led to the adoption of water to the extent of 2300-hp to be used to drive electrical generators, from which electric motors situated in all parts of the mill, though principally in the upper stories and in places where it was difficult to operate from water power direct, are supplied with power for running the looms and other machinery used in the manufacture of cotton. The majority of these motors, excepting those greater than 75-hp, are suspended from the ceiling on solid supports, thus economizing floor space, and are belted to line shafting, the long belt drives previously rendered necessary when operating direct from water power being obviated by this means. Moreover, the plant is a three-phase installation, the mo-

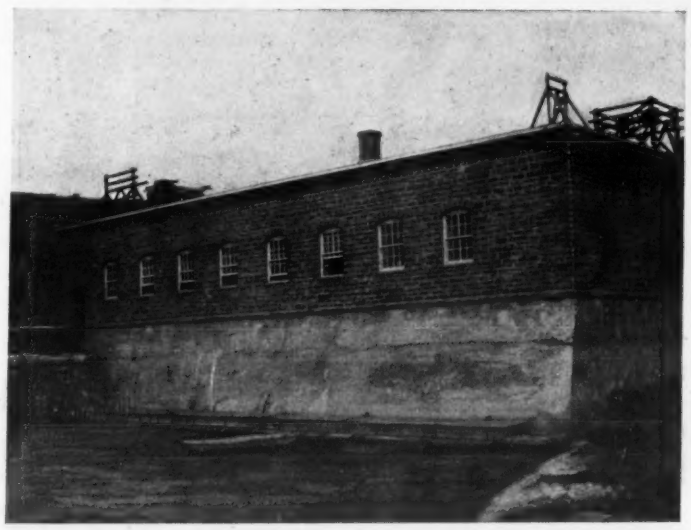


FIG. 2.—REAR VIEW OF POWER HOUSE.

tors all being of the induction type, the entire electrical equipment having been manufactured and installed by the Canadian General Electric Company, of Peterboro, Ont.

Water power is still transmitted direct to shafting in the lower floors where the drive is short, to the extent of some 2250-hp, but in a new mill in course of construction the entire machinery will be operated by induction motors, the present equipment having given such complete satisfaction. For this increase an extension will be made in the present power house to admit of some 3500-hp being added.

Summing up in short, we have here a private plant utilizing 4550-hp from water, half of which is for the electrical installation, and will be further augmented to 8050-hp within a short period.

WATER POWER DEVELOPMENT.

One of the numerous expansions of the St. Lawrence is known as Lake St. Francis, quite a distance above Montreal, at which point the opposite shores are nine miles apart. On an indentation of the shores of this lake, Hungry Bay by name, is situated the town of Valleyfield.

Years ago Hungry Bay was a small branch of the St. Lawrence, the river then being separated into two channels by an island, the smaller flowing into Hungry Bay, through the narrow channel between the island and the mainland, till it reached the main channel beyond. In this main channel, however, there are three swift rapids, navigable indeed, on the ocean journey by steamers of a certain size by dexterous piloting, but unnavigable for the bulky and slow-moving grain transporting barge. In order to overcome these rapids the government excavated a canal 12 miles long, the entrance to which is at Valleyfield in Hungry Bay; and to maintain a sufficient supply of water in this canal a dam was constructed between the island above mentioned and the mainland, completely blocking up the small stream, which has since been known as the Lost Channel of the St. Lawrence.

At this dam a head of 15 feet at high water and 11 feet at low water is obtainable, and there is the abundant supply of the entire St. Lawrence to draw upon. Here are located cotton mills, paper mills, pumping station and various other users of the advantageous position of this water power.

For the cotton mills a head race has been excavated 1000 feet long and tapering from 230 feet at the entrance to 165 feet wide at the exit, and varying in depth in the same manner from 10 to 15 feet, the walls being constructed of concrete faced with cement.

Water enters the four separate wheel pits situated along the head race in a direction perpendicular to the flow of the water through

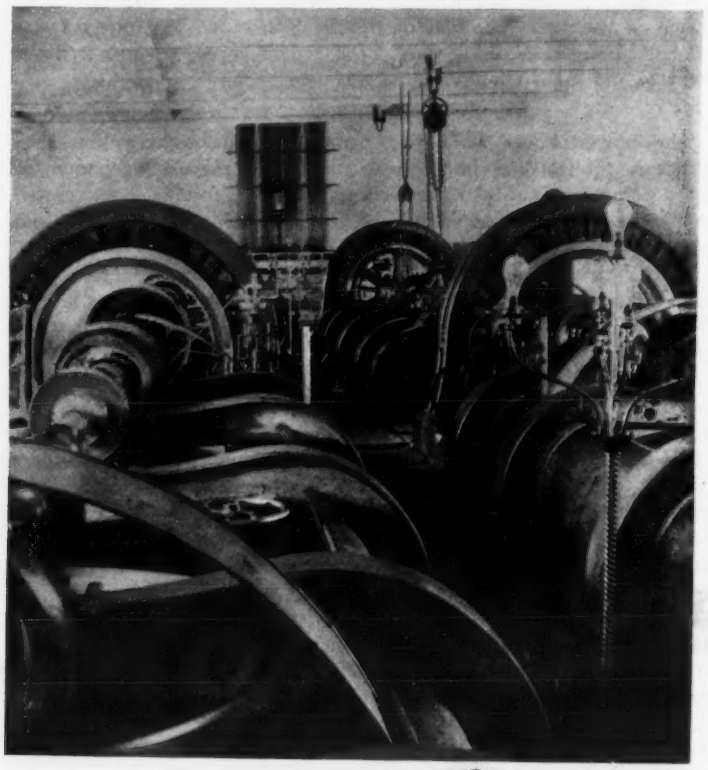


FIG. 3.—INTERIOR OF POWER HOUSE.

iron racks preventing any rubbish, which may have escaped the wooden boom at the entrance, from entering and injuring the wheels.

The above dimensions of the head race have been carefully calculated such that at no spot will there be a current greater than 2½ feet per second. By this method the freezing of the head race is insured, thus preventing the formation of any frazil or anchor ice in

the head race itself; and it is on a level with Lake St. Francis, whose surface is also frozen, with the exception of the rapids on the opposite side of the island, no trouble has been experienced with frazil. Sometimes after the first frost, previous to the formation of surface ice, a slight difficulty is encountered with ice clogging the racks, but it is removed by stopping the wheels in each pit in succession for only an instant when the outward surge produced sweeps all the ice to the end of the head race.

The entrance to the wheel pits are each 7 feet wide and 14 feet high and may be completely opened or closed in the space of one

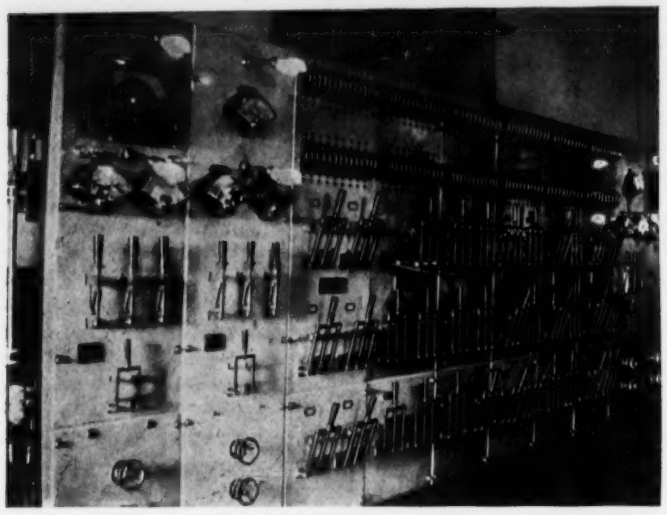


FIG. 5.—SWITCHBOARD.

minute by means of wooden gates, operating on hinges swinging upwards. These flumes are 53 feet long, passing under a portion of the mill before reaching the wheel pits; by being thus encased and air tight they are never frozen, so there is never the slightest difficulty in opening or closing the gates on account of ice forming inside.

Passing through the wheels, the water falls into the tail race, which is the Lost Channel of the St. Lawrence previously mentioned, having thus, as it were, been rediscovered, whence it flows away to the main channel some distance beyond.

POWER HOUSE.

The power house is a one-story, substantial, native limestone structure 101 feet long and 53 feet wide, a rear view being shown in an accompanying illustration, Fig. 2. The foundations erected on the bed rock are of solid concrete 7 feet thick at the base and tapering upwards.

There are two wheel pits, separated by a massive concrete wall, each containing four water wheels distant from each other 14 and 17 feet between centres transversely and in the direction of flow respectively.

The eight turbines in the two pits are each of the 60" vertical "McCormick" type built by the S. Morgan Smith Company, York, Pa., and capable under a guaranteed test of developing 268-hp each at 68 revolutions per minute under a normal head of 11 feet. They are directly coupled by means of heavy mortise bevel gearing to four separate jack-shafts, two wheels to each, placed in two rows extending the entire length of the power house; to the ends of each jack-shaft the generators are direct connected, the speed being 200 revolutions per minute. The standards on which this jack-shaft revolves is completely enveloped in a sheet iron casing, reducing to a minimum all danger to the operators of being caught in the massive cogs. A view of the interior of the power house may be seen in an accompanying illustration.

A Replogle mechanical water wheel governor is belted to each jack-shaft, operating, for any variation of speed, one of two friction clutches by means of which, with intervening gearing, the cylindrical wheel gates are raised or lowered according as the speed is too low or too high. In a test, the variation in speed is stated to have been only 1½ per cent. from no load to full load.

ELECTRICAL EQUIPMENT.

Situated at the termination of each of the four jack-shafts are the four three-phase generators, Fig. 4 giving a view of one. Each has a capacity of 400-kw at 200 revolutions and delivers current at a pressure of 600 volts at full load and at a frequency of 60 cycles per second. They are all of the ordinary stationary field type, and revolving armature type, the poles numbering 36, with three collector rings and brushes for the three-phase current.

For field excitation two 4-pole 17-kw machines are belt-connected to two of the four generators' shafts.

SWITCHBOARD.

The switchboard, consisting of ten white marble panels mounted on an angle iron frame, is situated at the extreme end of the power house. The two outer panels at each end are the machine panels, each containing the three single pole main switches, the field switch and synchronizing apparatus, the machines being coupled in parallel when the lamps are dark, the rheostats for the generator and exciter fields and lastly three indicating instruments—an ammeter in one of the three generator leads, a generator voltmeter and finally a direct-current ammeter for measuring the field excitation.

From the remaining six panels the complete installation of motors, arc and incandescent lights are controlled. No motor can be started or lamp lighted but by the switchboard attendant in the power house.

A system of signaling using magnetos and a drop shutter has been successfully adopted, the number on the drop corresponding to the number on the switch to be opened or closed.

By this method of station control, the voltage may be maintained uniform, which would otherwise be extremely difficult to do, on account of the rise of such large induction motors, requiring a great volume of current at the start. The motors are started or stopped singly, making the regulation easier both for the water wheel governor and the switchboard attendant. The revolving starting resistance for each motor is cut out as the speed increases, by the foreman of the room.

Enclosed fuses are placed in each lead on the face of the board,

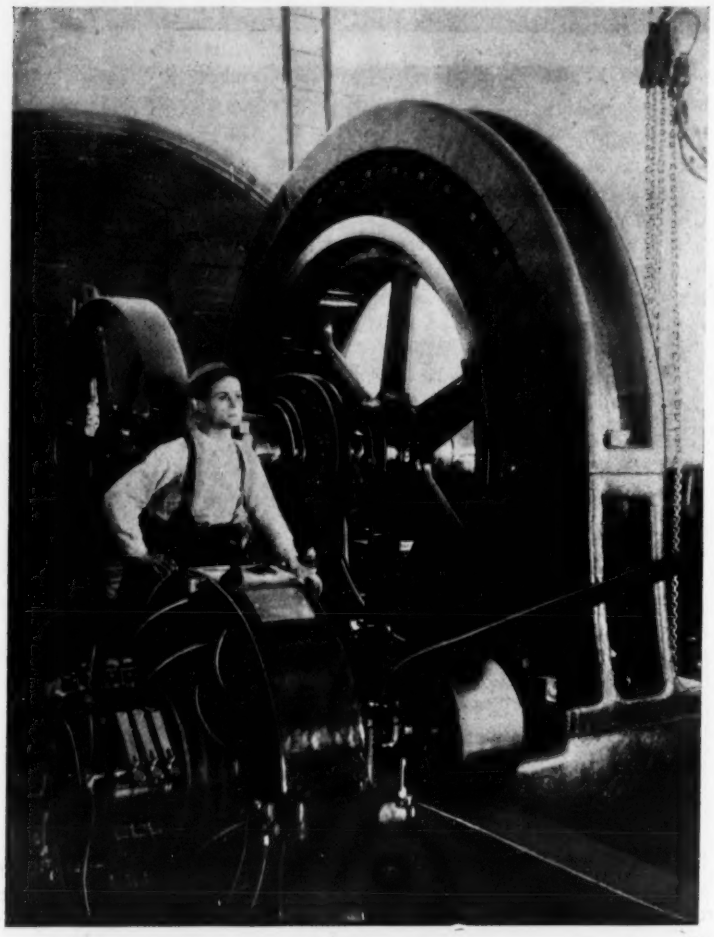


FIG. 4.—ONE OF THE GENERATORS AND EXCITERS.

from which the insulated wires pass to their respective destinations in brass tubing. On the rear of the board the fuses are separated from each other by papier maché barriers to prevent the tendency of the arc formed by a fuse blowing from jumping across to its neighbor and thus producing a short circuit. All the generator leads pass under the hardwood floor to the switchboard encased in lead armor. As a protection against lightning, choke coils and lightning arresters are used, being placed at the back of the switchboard.

The mills are lighted both by incandescent and alternating current arc lamps, supplied principally from the three-phase generators; a small direct-current plant, however, has long been installed and still supplies a few lamps. Current is also supplied to light a terrace of cottages erected by the Montreal Cotton Company and situated in close proximity.

The power house with its light-blue painted walls and ceiling and spotless varnished hardwood floor, presents a very bright and cheerful appearance.

For the increased installation the power house and head race will be extended, and two wheel pits constructed, each capable of containing six 60" McCormick vertical wheels developing each 268-hp at 68 r. p. m. under the normal head of 11 feet. Direct-connected to each of two jack-shafts, which are geared to the turbines by mortise bevel-gearing, will be a 1200-kw three-phase generator similar in type to those already installed. Water wheel governors of the Replogle type will be used, these having proved so successful in the present equipment.

Two 4-pole 85-kw Canadian General Electric exciters, each capable of fully exciting the whole plant, will be separately connected to two 45" "McCormick" wheels each developing 125-hp under the normal head of 11 feet. By thus operating them from separate wheels, the output is independent of the generator, which is not the case when driven from the generator shaft.

In the new mill, now under construction, all the machinery will be operated by induction motors ranging in size up as high as 250-hp.

DIRECT CURRENT PLANT.

As previously stated, there is a small direct-current plant situated in another part of the building. This is of very little account in itself, supplying but a small portion of the lighting, but is interesting on account of its equipment.

The generators are belt connected to a line shafting driven by a 54" vertical "Hercules" wheel developing 165-hp under a head of 11 feet.

These generators are all Edison machines of which two are of the standard two-pole type of 30-kw capacity each, two of six poles, and 20-kw capacity each, and three of four-poles and 10-kw capacity each, the latter five machines all being some of the original Edison machines with the long magnet limbs of the old days.

Should any accident occur to any of the electrical equipment, the old belts with little delay may be replaced and the machinery driven from the water power as of yore; but since its inception there has not been the slightest interruption in service, and the fact that the new mill will be equipped wholly with electrical apparatus fully demonstrates that no such trouble is apprehended and as such must be a source of gratification to the electrical public, the Canadian General Electric Company, who have manufactured and installed the machinery, to the Montreal Cotton Company and to Mr. Louis Simpson, general manager, and Mr. James Sparrow, mechanical superintendent, under whose management and direction the plant is successfully operated. To these latter gentlemen I desire to express my thanks for the readiness and willingness with which any information at their disposal has been imparted.

Magnetism and Molecular Rotation.

Lord Kelvin has announced a discovery in electro-physics which explains and correlates the magneto-optical phenomena discovered by Faraday, Kerr and Zeeman. The phenomenon announced is that an electrified body is set into rotation by generation of a magnetic field around it, and will in virtue of its inertia remain in rotation until the field is annulled. In a letter in the current number of the London *Electrician,* Lord Kelvin says that this assertion is not founded on observation but on the induction of an electric current in a metallic circuit in a plane perpendicular to the lines of force, from which it follows that an electrified ring of non-conducting metal must, by generation of a magnetic field, be set into rotation, in one direction if positively electrified, in the other direction if negatively electrified.

A Differential Method for Testing a Single Transformer.

BY S. E. JOHANNESEN.

AT the present time nearly all commercial transformers are built so that both high and low tension windings are adaptable to two equal voltages. That is, they are wound for 1000-2000 to 100-50 volts; 1040-2080 to 115-230 volts, etc. These ratios necessarily divide both windings into two equal parts, so that full capacity can be had at any voltage for which the transformer is wound.

The writer has devised a method by which a single transformer, such as described, may be tested under actual working loss conditions with an energy consumption equivalent to the transformer losses alone. This method, mainly gotten up for temperature tests of transformers, gives directly, approximately correct values for iron loss, leakage, copper loss, impedance and regulation.

Methods of connection for transformers having their windings divided horizontally or vertically as shown in *A*, *B* and *C* in Fig. 1, are given in Figs. 2, 3, 4 and 5, and for transformers having their windings divided as shown in diagrams *D* and *E* are given in Fig. 6. All the methods can be applied to either core or shell-type transformers.

In all figures R_1, A_1, W_1 and V_1 and *Rc*. *Ac*, *Wc* and *Vc* represent respectively, resistances, ammeters, wattmeters and voltmeters, for adjusting voltages and currents and for measuring iron loss and copper loss energy. *As* is an ammeter for measuring low-tension current; *Sc* S_1 represent respectively switches governing the currents supplying the copper loss and iron loss; *Sr* is a switch governing the pressure reducing transformers; S_2 a three-point switch used in connection with the regulation test. T_1 represents a transformer for stepping up the pressure of the current supplying the iron loss energy; *Tr* is a pressure reducing transformer used in connection with the iron loss and regulations measurements. *T* is the transformer under test.

The corresponding terminals of the separate coils in both windings are marked with like signs, so that by joining $-H$ to H_1, and $+H$ to $+H_1$, in the high tension winding, the two coils of that winding are connected in parallel; and by joining $-L$ to $-L_1$, and $+L$ to $+L_1$ in low tension winding, its two coils are connected in parallel. To connect coils in series join $+H$ to $-H_1$, in high tension, and $+L$ to $-L_1$, in low tension winding.

Fig. 2 refers to the case where the energy corresponding to all the losses is supplied to one winding only, in this instance to the high tension winding. Referring to the diagram, it will be seen that the current supplying the iron loss energy enters the high tension winding through the terminals $+H_1$ and $-H_1$; in other words the iron loss current is supplied across the terminals of one coil or one-half the high tension winding. The pressure must therefore be adjusted to the normal high tension pressure for which that coil is wound. For example, if the iron loss were to be measured on the high tension side of a $\frac{1\text{-}2000}{1\text{-}200}$ volt transformer, the voltage should be adjusted to the normal voltage of one coil or for 1000 volts, since the iron loss current passes through one coil only. The same is true if the iron loss were supplied to the low tension windings.

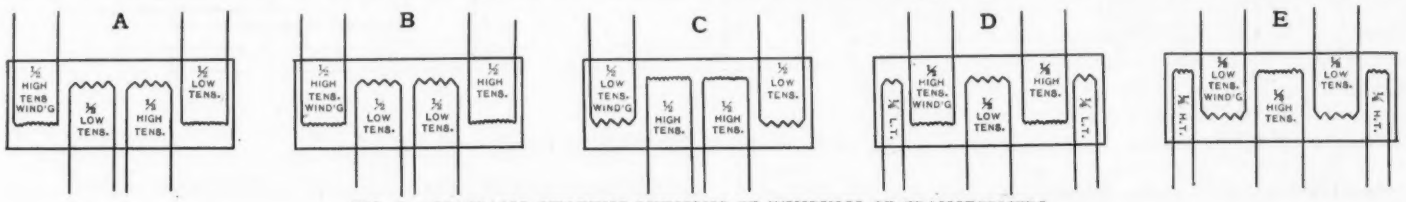


FIG. I.—DIAGRAMS SHOWING DIVISIONS OF WINDINGS OF TRANSFORMERS.

In this experiment, close switches S_1 and *Sr*, adjust pressure by resistance R_1 with all the instruments in circuit. The idle current or leakage is measured by the ammeter A_1; the pressure which is reduced by transformer *Tr*, by voltmeter V_1; and the iron loss energy by wattmeter W_1. Corrections must be made for the energy consumed by the voltmeter and by the pressure coil of the wattmeter.

The current supplying the copper loss energy enters the high tension winding through parallel terminals $-H$ and H_1. The low tension winding is short circuited through an ammeter *As*. In reality, the low tension coils are connected in parallel. In test, close the switch *Sc* and adjust the pressure by the resistance *Rc*, with all the instruments in circuit. *Ac* measures the current supplied; the volt-

meter *Vc*, the pressure and the wattmeter *Wc*, the energy consumed. The same corrections are to be made for the voltmeter and pressure coil of wattmeter as in iron loss test.

The watts registered on the wattmeter *Wc* should correspond to the watts of copper loss measured in the ordinary way; that is, by short circuiting the low tension winding through an ammeter and supplying pressure to the high tension winding until the full load current passes through the low tension winding.

In testing transformers having small capacity and high impedance, by the differential method as shown in the diagram, it was found that the copper loss energy as registered by the wattmeter, was in excess of what it should be when sufficient pressure is supplied to the high tension winding to create full load current in low tension. The copper loss energy registered by wattmeter *Wc* was found to be approximately correct when the current supplied was the mean of the full load high tension current, and the current which is taken up in the high tension winding when full load current passed through the low tension, or vice versa.

For instance, in a 1000 to 100-volt, 20-light transformer, in which the high tension winding was divided into two 500-volt coils, and the low tension into two 50-volt coils, the current which passed through the low tension winding was 8.3 amperes when a full load current of one-ampere was sent into the high tension; and when a full load current of ten amperes passed through the low tension coil, 1.2 amperes were sent into high tension. The mean of these high tension currents, 1 1-10 amperes was found to give the copper loss corresponding to the correct wattmeter copper loss. The pressure required to send 1 1-10 amperes through high tension was approximately the correct impedance.

In transformers having larger capacity and lower impedance, the discrepancy in wattmeter copper loss measurements did not occur. The correct copper loss is calculated from the resistance.

The regulation is measured as follows: With switches *Sc* open and S_1 and *Sr* closed, the pressure is adjusted to the normal potential of the coil across which it is connected, after which both high and low tension open circuit readings are taken. Then Sc is closed and the voltage of its circuit is adjusted by the rheostat *Rc*, so that the correct copper loss energy is registered on wattmeter *Wc*. The pressure of the iron loss circuit is again adjusted to normal high tension pressure, and the closed circuit high and low tension readings are measured on the voltmeter, *Vr*.

The voltage drop or regulation is determined in the ordinary way. Let *a* and *a'* represent high and low tension open-circuit pressures; *b* and *b'* their respective closed circuit pressures. The regulation or volts drop will be $\frac{a'\ b}{a} - b'$. The percentage drop will be, for a transformer with a secondary wound for 100 volts,

$$\frac{\left(\frac{a'\ b}{a} - b\right) 100}{50};$$

for a transformer with 110-volt secondary,

$$\frac{\left(\frac{a'\ b - b}{a}\right) 100}{55};$$

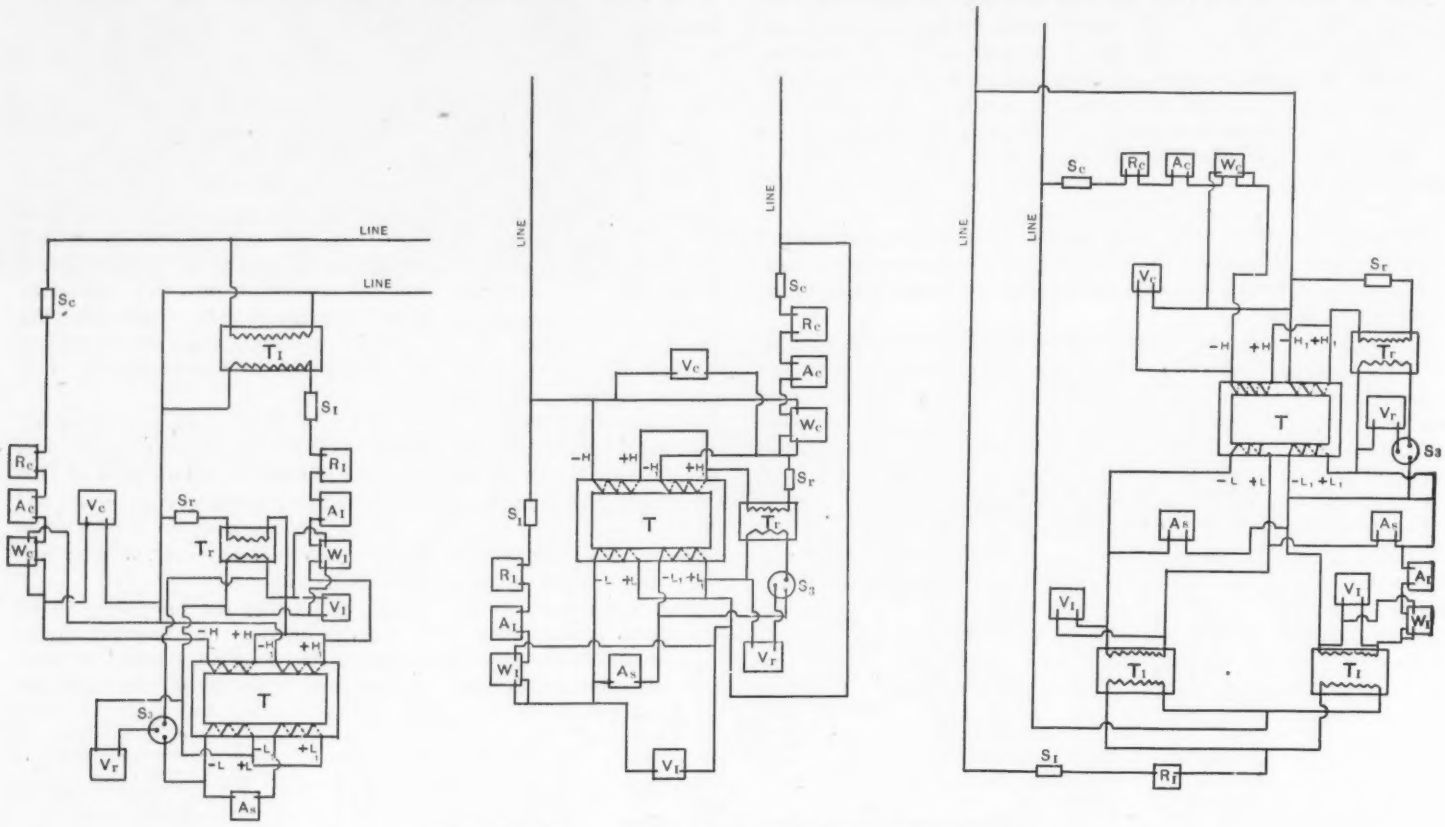
and for a transformer with 200-volt secondary

$$\frac{\left(\frac{a'\ b - b}{a}\right) 100}{100}.$$

The volts drop or percentage regulation can also be determined from the resistance, impedance and magnetizing currents, by formulaes already generally known.

The connections for temperature test are the same as shown in the diagram, excepting the pressure reducing transformer *Tr*, which is cut in only when adjusting the pressure of iron loss circuit. To determine the rise in temperature it is necessary to keep the amperes passing through the low tension side constant from the beginning to the end of the run. As the temperature increases, the energy required to force the current through the low tension side will also increase, and it is measured directly by the wattmeter *Wc*. Let *w* represent the copper loss energy at beginning of run, and w_1 the energy at end of run; then $\frac{w_1 - w}{0.4\ w}$ = the rise in centigrade degrees. Or more correctly, let R_H and R_L represent respectively high tension and low tension resistances at beginning of run, and $R_H{}'$ and $R_L{}'$ resistances at end of run; then the rise in temperature in centigrade degrees is equal to

$$\tfrac{1}{2}\left(\frac{R_H{}' - R_H}{0.4\ R_H} + \frac{R_L - R_L{}'}{0.4\ R_L}\right)$$

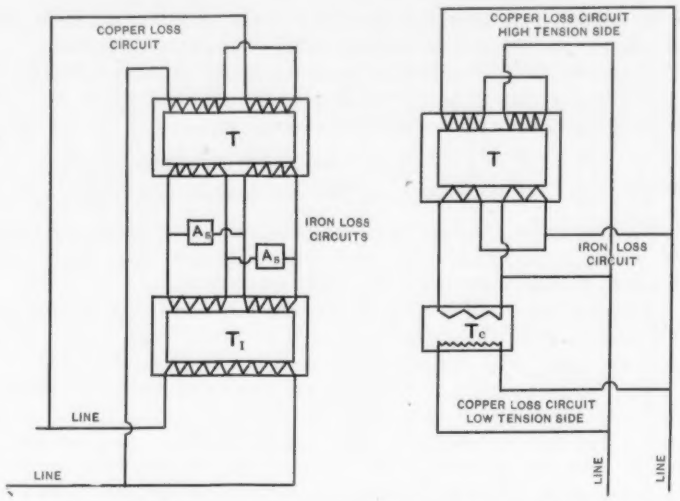


FIGS. 2, 3 AND 4.—DIAGRAMS OF CONNECTIONS FOR TESTING.

Fig. 3 represents a method whereby the iron loss energy is supplied to one winding, and the copper loss energy to the other. In the diagram the copper loss is supplied to the high tension side and the iron loss to low tension side. There is no advantage in this method over that illustrated in Fig. 2 other than that both copper and iron losses can be supplied from the same circuit without transformation. Measurements are made in the same way as described in method illustrated in Fig. 2.

Fig. 4 shows a modification of Fig. 3, in which the iron loss energy is supplied by two separate circuits (separated by transformation). This method was found to practically eliminate the discrepancy in wattmeter measurements of copper loss, transformers of small size referred. Two ammeters *As* and *As* measure the above full low tension currents. It was found that the sum of the currents registered on both ammeters was exactly the inverse ratio of the winding; that is, in a 1000 to 100-volt transformer, the total current measured on both ammeters, *As, As,* on the low tension side was found to be ten times that supplied to the high tension.

The method illustrated in Fig. 5 is also a modification of that of



FIGS. 5 AND 6.—DIAGRAMS OF CONNECTIONS FOR TESTING.

Fig. 3. Here the iron loss is supplied by two separate circuits from a single transformer; it partly eliminates the wattmeter copper loss discrepancy, but is not as accurate as the method of Fig. 4.

If the transformer windings are divided as shown in *D* and *E*, Fig. 1, it is necessary to supply the copper loss energy separately to both high tension and low tension windings. The method of connections is illustrated in Fig. 6.

In Figs. 5 and 6 all instruments and adjusting devices, excepting the low tension ammeters in Fig. 5, are left out. Their connections and adjustments are the same as described in the method shown in Fig. 2.

Arc Machine Regulation.

BY H. FRANKLIN WATTS.

The Thomson-Houston system of arc lighting having established itself in nearly every quarter of the globe, is now so well known and understood that any remarks pertaining to its operation may at this late date appear rather untimely.

While the writer verily believes that it is not yet too late to learn the old dog a new trick or two, he has no intention of doing so at the present moment, but will direct his remarks mainly to the systems of regulation employed in some of the arc systems now in extensive use and to criticise some of the regulators, and above all to suggest a remedy for their shortcomings. He may as well say at once that there is, in the writer's opinion, no system of arc machine regulation in the world that can touch the Thomson-Houston in point of reliability, simplicity or character of the results obtained. Nor is it at all likely that the next twenty years will witness any material improvement in this direction. Of course, to do away with the necessity for a regulator of any kind by "inherent regulation" or otherwise, would constitute a great improvement, but while we hear much about "inherent regulation," it does not appear to warrant the importance that has been attached to it. "Forced regulation" must still be employed to compel the machine to do what it would not otherwise do. This applies more particularly to the machine first mentioned, but also in a large degree to certain other dynamos that lay great claims to this feature; but whether inherent or forced, the T-H regulator does its work so well that one is apt to forget that the controller on the wall has any part or interest in what the machine is doing. It virtually takes the place of a faithful attendant, and sleepless and tireless, is ever adjusting and readjusting the current to standard strength.

The regulator is the heart of any system, and it matters not how good the design of the dynamos may be, it cannot give good results unless the current is held very closely to its correct amount and the closer the regulation the better is the service. The regulator is to the arc dynamos what the governor is to the steam engine. No engineer would think of running his engine with its governor disconnected under the excuse that the load is "constant" and that the governor was not needed; yet it is very common to find arc dynamos—of the very latest type too—whose regulators (?) are out of service, the real reason being that it has been found to be a very ticklish and difficult thing to adjust them, there being several different points to adjust. Furthermore, when all adjustments have been made, they are not permanent, and perhaps the next night the whole operation must be repeated. No wonder the dynamo man gets disgusted and disconnects it altogether and regulates by hand.

Did any one ever hear of a T-H regulator being disconnected? The writer has known these regulators (the T-H) to do their work for years with absolutely no attention. He has also observed that after being transported hundreds of miles by freight, on starting up it is found the original adjustment made in the factory is still correct to 1-10-ampere. Is there any other arc machine regulator in the world of which this can be said?

There are many plants in this country operating a large number of T-H arc dynamos with the number of attendants reduced to an extent that would be impossible with any other system. A certain station has four large compound condensing engines and 28 arc dynamos, besides several incandescent machines and a few alternators. But two men are on duty at night in the machine room, one of whom looks after all the dynamos, with the occasional help of one of the firemen if anything goes wrong.

Some regulators have a formidable array of spur gearing, friction wheels, pawls and ratchets, brought into action by a magnet in the main circuit. The friction wheels become worn, the ratchet is soon smooth, lost motion takes place, the play of the magnet armature is increased; it loses its sensitiveness, two or three amperes variation being necessary to start it, and when it does start it is apt to go too far and over-correct the current. A magnet having much range of movement and considerable mechanical labor to perform cannot possibly be sensitive to small variations of current, especially when pulling against a strong spring and stiff dash pot, unless it is under control of a relay. This brings us back to the T-H regulator, whose controller has nothing to do but to jump up and down, in response to current changes, and herein again lies its superiority.

The T-H regulator is essentially the station man's friend; indeed, no friend or brother was ever truer to his principles than is this simple device which, through the long hours of the night, amid the swish of belting and the clatter of air blasts, unnoticed, uncredited, performs its exacting and monotonous duty with a zeal and fidelity that knows no mistake.

As is well known, these machines are no longer manufactured, and with them has gone the heart and soul, and, to many minds, the secret of the success of the T-H arc system. For the demise of the dynamo with its inaccesible armature few tears will be shed, but for the regulator there is no lack of mourners who bewail its untimely end.

Instead there has been developed a line of two and four-pole machines which, regarded as generators of electricity, are far superior to the ones thus discarded, having features of great value, such as very heavy insulation, greater accessibility of the armature and withal in much larger sizes and doing away in large plants with the proverbial "acres of dynamos;" but, I regret to say, many having regulators which are not possessed of one redeeming feature or a single excuse for life.

The central station manager of experience who regards the breaking down of his machinery as a great calamity, often spending thousands of dollars in duplicating engines and dynamos, regards these machines with a critical eye. He admires their solid, substantial construction, the large shaft with self-oiling bearings. He approves of the tremendous insulation on the armature and its positively-driven coils as well as the absence of band wires. He notes with pleasure the large and broad driving pulley, also the moderate speed of the armature and the generous proportions of the commutator, on which a great deal of care has been bestowed. But when he looks at the regulator it gives him a pain and he very naturally inquires: "Why don't they put the T-H regulator on this machine, thus reflecting credit upon the factory and station alike?" Don't tell him this cannot be done. Such a thought is silly. He knows better. The T-H regulator magnet is very powerful and

can easily be made more so if necessary. He has no use for sewing machine belts, worm gears or magnetic clutches. He sees no necessity for oil pumps, balanced valves or rotary pistons.

Years of experience has taught him that there is no more necessity for a rheostat on an arc machine than for an extra tail on a cow. Why is he so sure of all this? Because he has seen it done for years, not on this machine it is true, but on one of much poorer electrical design, and far more difficult to regulate, and which, moreover, lays no claims to "inherent regulation by armature reaction," and accomplished too, with none of the contraptions above mentioned. It matters not how different the characteristics of the machines may be, this regulator will regulate it and do it well if it is given a chance.

The designers of one of these dynamos, for whom the writer has the highest regard, states that by the use of the rheostat he saves 650 watts at one-quarter load out of a total of 62,000—equal to about 1 per cent.; and that by winding more wire on the armature, the machine would deliver its standard current at all loads without the rheostat. Yet to save this 1 per cent., which is done at one-quarter load only, he finds it necessary to encumber his machine with a useless and complicated device which has no business on an arc machine, in which freedom from breakdowns should be the first consideration. First reduce the probabilities, then the possibilities of accident.

Will the stockholders, manager, engineer, financier or machine man ever know whether the 650 watts is saved or wasted? Is not economy secondary to reliability? Nothing short of an indicator or wattmeter will ever know the difference, especially as a machine and engine of this size are not likely to be run at one-quarter load for any great length of time.

Prof. Thomson might also have applied a rheostat to his machine and with even greater advantage, since his dynamos (the 50-light) cannot be operated safely at small loads unless the field is shunted; but he apparently decided that it would add too much complication, his aim being to produce a machine of the greatest possible simplicity, and which could be operated without expert attention.

Better wind more wire on the armature, throw the regulator and rheostat overboard, and substitute the Thomson-Houston regulator. There will then be combined in this machine the cream of two systems, all of their good points and none of their bad ones—a machine far superior to many of the later types supposed to be the highest expression of the designers' skill.

On a Possible and Rational Simplification of Electric Units.[1]

BY PROFESSOR A. BLONDEL.

THE electric units have assumed in industrial practice an importance which is extending every day, and there are few engineers who can in future afford to ignore them, while eminent scientists frequently avail themselves of these units to the fullest extent. It is impossible, therefore, to over-estimate the importance of their nomenclature or definitions.[2]

On carefully examining these units from an impartial standpoint and divesting one's self of whatever habits he may have formed by long usage of them, it is impossiblle to avoid being struck with the confusion which arises from the coexistence of two systems. There exists, in fact, not merely one, but actually two systems, of electromagnetic units; namely (1) The C. G. S. System, perfect in its definitions, founded upon the centimetre, the gramme and the second; and (2) the practical system, of the ampere, the ohm and the volt, which is based upon the terrestrial quadrant, 11^{-11} gramme, and the second.[3]

The relations between the two systems are in fact not simple, since the practical units are deduced from the C. G. S. system by very varied powers of 10; i. e., -1, 8, 9, -9, 7, etc., and in many cases multiples of these multiples are adopted. It is necessary, therefore, to make a regular calculation to pass from one system to the other, and finally not less than 14 powers of 10 are employed, as the accompanying Table 1 shows. There is presented, moreover, a curious contradiction in these two systems; namely, that in electricity the practical system is almost exclusively employed under the pretext that the C. G. S. units do not possess concrete names and that their magnitudes are too great or too small for practical purposes. On the contrary, in magnetism, where the concrete names are equally absent and where the unit of magnetic flux is certainly too small, no practical unit has thus far been adopted.

It results from this that the practicians, notably machine constructors, are obliged to employ both systems coincidentally, and in order to avoid the risk of making mistakes, they have introduced into technical literature empirical equations which are very distressing to the eye of the physicist, such as,

$$\mathcal{F} = 0.4\,\pi\,N\,I \text{ for magnetomotive force}$$

and

$$E = N n \Phi \times 10^{-8} \text{ for electromotive force.}$$

Finally, under the pretext of simplification, practicians are forced to adopt for their calculations a unit of length equal to 10^{-9}, the neglect of which gives rise to numerous errors.

Every effort made during the last few years to reconcile the electric and magnetic practical systems has remained unfruitful. Some, in accordance with the American Institute of Electrical Engineers, have proposed simply to unite the practical magnetic units with the C. G. S. units and to give them names such as the gauss, weber, etc. But this proposition, which is opposed to existing conventions, does not settle the question, as it only changes the form and not the basis of the units, and for this reason the proposition has remained isolated up to the present time.

Others, among them myself, have believed that the solution could be found logically in the creation of new practical magnetic units coherent with the practical 10^{-9} centimetre, 10^{-11} gramme, second system, of which they constitute the outcome, but by following the relations of the corresponding dimensions,

$$4\,\pi\,n\,I = \mathcal{H}\,L,\ E = \Phi/T, \text{ with } \Phi = \mu\,\mathcal{H}\,S \text{ in air.}$$

it must be admitted that the magnetic permeability of air is not unity as ordinarily assumed, but 10^{9}, which is as unsatisfactory as taking 10^{9} for the practical unit of length. It is also to be feared that a new system of this kind could not hope to secure the adherence of electricians in general, partly because it would require the knowledge of new names and new definitions, and partly because it would give rise to confusion with the American system. It would be a logical system and would dispense with the necessity of practicians being acquainted with the C. G. S. system, but it would not suit physicists and would only increase the number of units they had to learn.

In the presence of these facts, one is compelled to recognize that the most radical and simple solution of the unification of electric and magnetic units for practical requirements would be to employ but a single system, the C. G. S. system, and one is led to question the utility of the practical system and even the necessity for its existence.

It is easy to see that on the one hand this necessity no longer exists, and moreover, that it would be very easy to dispense with this system at the present time.

In fact, at the time when this practical system was devised by Sir William Thomson, a quarter of a century ago, nothing was known of modern industrial electricity, and a single application only was kept in view; namely, telegraphy. It was not astonishing, therefore, that the C. G. S. unit of current was found too large, and that it was considered necessary to replace it by a unit ten times smaller. But this reason no longer exists, when we have networks of distributions in large cities counting their amperes by thousands. Similarly, as we have to-day energy distribution systems operating at pressures up to 40,000 volts, nothing would prevent our employing a unit of pressure ten times greater than the volt.

It is easy to see that these two simple changes would render uniform in the most happy fashion the ratios between the practical and the C. G. S. units, in bringing them all to a single power of 10; i. e., 10^{-9}. The existing hektowatt would become the unit of power, and this would also be an advantage.

But as soon as there only remains a single ratio why should it be necessary to give to the C. G. S. units multiplied by this ratio any

[1] We quote as follows from a letter accompanying Prof. Blondel's paper:
"I have just read your able and interesting editorial 'On the Desirability of Names for the Fundamental Electric and Magnetic Units,' and am both pleased and disappointed therewith—pleased because your ideas are almost exactly those at which I arrived some months ago after having previously held others opposed thereto; and disappointed because the editorial anticipates a paper I had prepared on the same subject last December for presentation at the coming September meeting of the French Association for the Advancement of Science, the original manuscript of which I send you, without any change, for publication, should you desire to make that use of it. The coincidence is a strange one, but the ideas involved would probably come naturally to the mind of every electrician meditating on the subject of units."

[2] See the remarkable account of M. Cornu, "Unitéa Electriques," in the Annuaire du Bureau des Longitudes for 1899.

[3] It is, therefore, wrong to characterize certain authors as employing the C. G. S. system when in reality they employ the practical system, which is altogether different.

special names rather than to designate the multiplication itself by a single prefix like those which are already used—deka, hecto, kilo. It is logically evident that the same method can be employed to designate the factor 10^{-9}.

Reason no longer exists for employing the troublesome 10^{-9} centimetre, 10^{-11} gramme, second system, side by side with the C. G. S. system, since the latter can serve alone for all possible applications. It is only necessary to complete the system by giving names to the electric units, as the Americans have already done to the magnetic units, and for the same reasons. Their attempt, which in an isolated form is illogical, then becomes excellent and worthy of adoption. There is only one difficulty presented; namely, the choice of the names to be given to these C. G. S. units. On the one hand we are so accustomed to volts and amperes that it would be very difficult to adopt new words, and besides it would be very deplorable that the names of the pioneers in electricity should be replaced by names of scientists less celebrated, or less directly associated with the first developments of this science.

On the other hand, one could not, however, retain the names unchanged without the danger of giving rise to continual confusion between the two systems; namely, the one to be abandoned and the new one. But everything could be happily adjusted by adding, for five or six years, the prefix "neo" before the names of the C. G. S. units. For example, the C. G. S. units of pressure, current and resistance would be called the neovolt, the neampere, and the neohm, etc. At the end of five or six years, after the decision of the Congress which would have adopted the change, these new habits would be acquired very easily, owing particularly to the influence of the new generation of electricians issuing annually in increasing numbers from the schools, where they would have learned these habits, and one could soon allow the prefix "neo" to drop by common agreement. This would be the more easy since the new régime would start with the commencement of the twentieth century, and the date of a publication would immediately inform the reader as to which system applied to its contents. As for the multiples of the C. G. S. systems of units, thus denominated, their names being new in the electric language, as is shown in the appended table, could not give rise to any confusion with the old, and this would dispense with the addition of the prefix "neo" in the multiples of the C. G. S. system of units, thus denominated; moreover, the meaning of the prefixes—mega and micro—would be changed to 10^{15} and 10^{-15}, instead of 10^{6} and 10^{-6} as at the present time. The megohm and microfarad would thus retain their already existing values.

The powers 10^{9} and 10^{-9} would be designated by the prefixes "hyper" and "hypo," respectively. The actual ohm and the dekavolt would become the hyperohm and the hypervolt, and the hektowatt would become the hyperwatt and would be designated by the same abbreviation as at present. The microhm would become the kilohm. It is evident that all the principal units would remain extremely simple, and that any electrician would learn to employ the new system in a few minutes.

To define these changes more precisely, and to illustrate all the logical and practical importance of the new system, the two accompanying comparative tables indicate the names and ratios of the units in the old terminology and in that which I propose.

A glance at these tables suffices to indicate the simplicity of the second in comparison with the complexity of the first.[4]

It would be easy, for example, to accustom oneself to say 11 hypervolts instead of 110 volts; 10 neoamperes instead of 100 amperes, the hyperwatt instead of the hektowatt, etc. Medical men who ordinarily employ currents between 1 and 200 milliamperes would count them between 0.1 and 20 milliamperes, etc.[5]

NOMENCLATURE OF UNITS AND THEIR USUAL MULTIPLES. TABLE I.—PRESENT SYSTEM (PRACTICAL).

MULTIPLES OF C. G. S. UNITS.	10^{-15}	10^{-11}	10^{-9}	10^{-7}	10^{-4}	10^{-1}	1	10^{2}	10^{8}	10^{7}	10^{8}	10^{9}	10^{10}	10^{15}
Length	....	.....	....	.....	....	....	....	....	....	....	....	Quadrant	....	....
Mass	....	Practical Unit of Mass	....	.....	....	....	....	....	....	....	...	....	....	....
Time	....	.....	....	.....	....	....	Second	....	....	...	....	....	....	....
Current	....	.....	....	Microampere	Milliampere	Ampere	....	....	....	....	....	....	....	....
Voltage	....	.....	....	.....	....	....	....	Microvolt	....	....	Volt	....	....	....
Resistance	....	.....	....	.....	....	....	....	....	Microhm	....	....	Ohm	....	Megohm
Quantity	....	.....	....	Microcolomb	...	Coulomb	....	....	....	....	....	....	....	....
Power	....	.....	...	.....	....	....	....	....	....	Watt	....	Hectowatt	Kilowatt	....
Energy	....	.....	....	.....	....	....	....	....	....	Joule	....	....	....	....
Inductance	....	.....	....	.....	....	....	....	....	Microhenry	....	....	Henry	....	....
Capacity	Microfarad	.....	Farad	.....	....	....	....	....	....	....	....	....	....	....

The advantages which would, in my opinion, justify this new system, which would be nothing in fact but a legitimate restoration of the legitimate system to the detriment of its usurper, would be very imporant.

First of all, it would facilitate very greatly the teaching of electricity. Many efforts must be made to-day by students to understand the relations between the two systems, and particularly to understand why after having demonstrated to them the beauties and logic of the C. G. S. system they have to employ a totally different system. Everything would be perfectly clear under the new plan. More generally, this question of units would no longer raise itself in its complexity like a Chinese wall before engineers who are not electricians, but who are desirous of informing themselves, because from the point of view of application, as well as from the scientific point of view, the practical system constitutes to my mind a veritable anachronism which imposes a work of memory that is absolutely useless and sterile.

NOMENCLATURE OF UNITS AND THEIR USUAL MULTIPLES. TABLE II.—PROPOSED NEW SYSTEM (COMPLETE C. G. S.).

MULTIPLES OF C. G. S. UNITS.	10^{-15}	10^{-9}	10^{-3}	1	10^{3}	10^{9}	10^{15}
Length	.....	.....	.....	Centimetre	.....	.....	.....
Mass	.....	.....	.....	Gramme	.....	.....	.....
Time	.....	.....	.....	Second	.....	.....	.....
Current	.....	Hypoampere	Milliampere	Neoampere	.....	.....	.....
Voltage	.....	.....	.....	Neovolt	Kilovolt	Hypervolt	.....
Resistance	.....	.....	.....	Neohn	Kilohm	Hyperohm	Megohm
Quantity	.....	Hypocoulomb	.....	Neocoulomb	.....	.....	.....
Power	.....	.....	.....	Neowatt	.....	Hyperwatt	.....
Energy	.....	.....	.....	Erg	.....	Hypererg	.....
Inductance	.....	....	.....	Neoheury	.....	Hyperheury	.....
Capacity	Microfarad	.....	.....	Neofarad	.....	.....	.....

Finally, one would suppress the above-mentioned contradiction between the electric and magnetic units, and the system of magnetic units of the American Institute might be definitely accepted,

[4] It will be observed that I have limited the employment of multiples in my table to the third, ninth and fifteenth powers of 10. In reality nothing would prevent the creation of others the moment that it was judged useful to do so. One could even generalize and render uniform the mode of formation of these multiples in forming regular triads of the powers of 10. One would have, for example:

kilo 10^{3}	duo 10^{6}	tri 10^{9}	quarto 10^{12}	quinto 10^{15}
milli 10^{-3}	billi 10^{-6}	trilli 10^{-9}	quatrilli 10^{-12}	quintilli 10^{-15}

The intermediate powers have no need for special prefixes, because one can always count without difficulty from 1 to 1000 in the intervals. I believe, however, that it is well not to ask for too much at once and to content oneself with the powers 9 and 15.

[5] As the kilowatt occupies an important industrial place, it might be possible to preserve this unit as an exceptional case under the name of kowatt, for example, in order not to confuse it with 10^{3} times the neowatt.

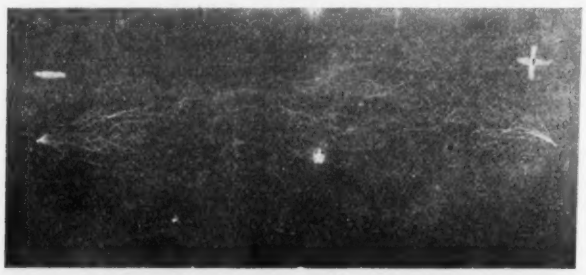
thus avoiding the danger of schism which threatens in that quarter. The bastard equations above referred to would cease to be useful, since all the units would be coherent. One would know that a flux of one weber cut per second would correspond to the e. m. f. of one volt, and that the self-inductance of one heury is that which corresponds to one volt produced by a variation of one ampere per second, etc. Powers which intervene as multiples being always indicated by prefixes, one would never run the risk of forgetting them in calculations, as happens only too often to-day.[6]

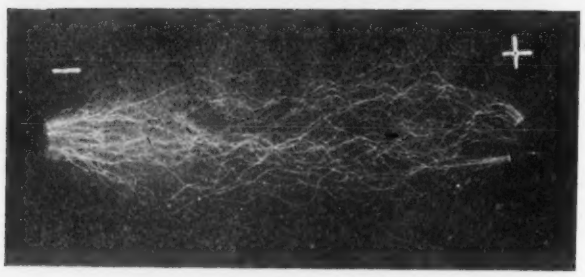
This would be a splendid task for the Electrical Congress of 1900, and I hope the Congress will take it up. I should be happy if, without waiting for this Congress, physicists and engineers whom the subject may interest, would discuss this idea which I submit to-day, and concentrate their efforts to perfect it, and in preparing for its realization if they accept it.

Wehnelt Interrupter Phenomena.

A SERIES of experiments on the Wehnelt interrupter have recently been conducted in the electrotherapeutic laboratory of the University of Michigan by Mr. Benjamin T. Bailey, under the direction of Prof. W. J. Herdman, which brought out a number of points of interest to those working toward the practical perfection of a device which, though promising much, is often found unsatisfactory in operation.

The experiments were largely carried out with interrupters made in the laboratory. Several were made by sealing platinum wires in glass tubes, but all gave trouble by cracking upon the least overheating. The form from which gave the best results was made by soldering a short piece of No. 22 platinum wire to the end of a piece of copper wire. The whole was then passed through a small fibre or hard rubber tube, the bore of which was just large enough to contain the wire. The platinum was left projecting from 1-10 to ¼ inch, according to the frequency desired and the current it had to carry. The wire was then sealed in by gently heating the tube and moulding it around the wire. For the cathode a lead plate 2x3 inches was used, and for the containing vessel an ordinary tumbler. The strength of solution most used was one part of sulphuric acid to five of water. This interrupter is very easily made, and works well on from four to ten amperes. The voltage may vary from 30 to 220 or more volts.





FIGS. 1 AND 2.—TYPES OF DISCHARGES.

An interrupter made by Ernecke, of Germany, was also used. It had a jar of about two quarts capacity and a large lead cathode. The platinum anode projected horizontally into the liquid, and was adjusted by means of a screw. This worked well at first, but it seemed impossible to keep the joints tight enough to prevent the nascent oxygen from attacking the hard rubber support of the anode.

For a non-inductive resistance a water resistance was used, and for an inductance, an old ⅛-hp motor field, wound with 200 turns of No. 18 wire, with taps brought out, so that from 10 to 200 turns could be connected in series. The induction coil employed gave a twelve-inch spark, and worked ordinarily with two storage battery cells. The primary resistance was .051 ohms, that of the secondary 1700 ohms.

The interrupter, coil, non-inductive and inductive resistance were connected in series. With an applied e. m. f. of 85 volts the various drops were, over the interrupter 40 volts, the inductive resistance

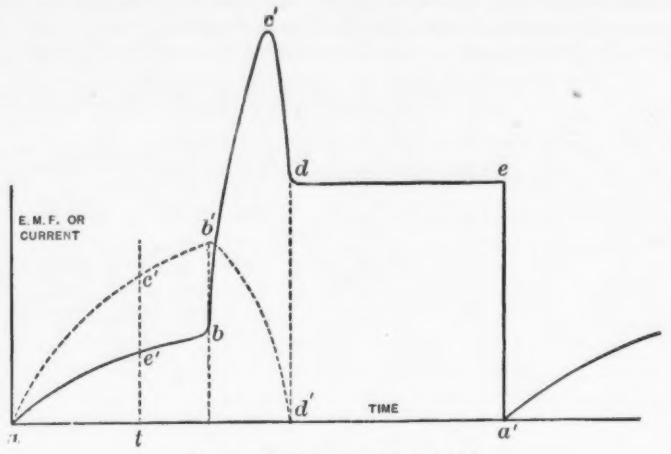


FIG. 3.—CURVE OF POTENTIALS.

3.7 volts, the non-inductive 35, and over the coil 0.7 volts. With 220 volts the drops over the inductive resistance and over the coil remain the same, but those over the interrupter and resistance rise to 108 and 98 volts, respectively. The current used was seven amperes. No change in the connections of the coil was necessary; the vibrator was merely screwed up a little so it could not respond. The number and intensity of the sparks was much greater than with the usual vibrator. Increasing the self-induction, lengthening the exposed platinum point, or lengthening the spark gap, which, of course, increases the self-induction, all lowered the rate of interruption. As the frequency increases, the length and number of sparks increases, but the violence of the sound in the interrupter and the light around the anode become less.

The spark given by this arrangement is peculiar. (See Fig. 1.) With a six-inch spark gap, a portion of the spark, about one inch long, is thicker than the rest. It begins about one-half inch from the negative pole, and the point of change of width is quite strongly marked. At the positive pole the sparks are clear cut and distinct, but near the negative, before the enlargement begins, they are very indistinct and blurred. This is not due to a lack of focus, as just beyond this point they are perfectly clear. The exposure given was about 1-20 second, and the picture thus presents about what the eye sees in looking at the discharge. With a very high frequency and the discharging rods close together, the number of sparks seen at one time becomes so great that the discharge resembled that of a Tesla high-frequency coil.

If now an ordinary single focus Röntgen-ray tube be connected to the discharging rods of the coil, it lights up brightly with the well-known greenish color. In appearance it can not be distinguished from the same tube worked with the ordinary vibrator, but on account of the higher frequency of the secondary discharges the Röntgen-ray effects are greatly intensified. The heating is no greater than usual with the same brilliancy, but a much greater current can be forced through in this way when, of course, the heating will be greater.

This is rather an expensive method of operating a coil, as it requires about 1-hp at 110 volts. With a coil especially constructed for such work, the primary being wound with enough wire to give all the self-inductance needed, ⅛-hp would be sufficient, unless a particularly slow rate was desired. At first sight it appears as though the interrupter itself was responsible for a great loss of energy. With 220 volts there are apparently $65 \times 7 = 455$ watts wasted in the interrupter. That this is not the case was easily shown. To test this the apparatus was connected to the 220-volt circuit and measurements taken. The drop over the interrupter was 65, over the water rheostat, 150. With 7 amperes passing for

[6] All my remarks result from the observations that I have had occasion to make among pupils and young engineers. As I have already stated, to judge the proposition fairly, one must place oneself in the point of view of one who has to learn electricity and not of one who has long been acquainted with it; and become imbued with the idea that the most sure means of working for the diffusion of a science as well as of a language is to simplify its orthography.

four minutes, the rise in temperature (centigrade) was for the interrupter 18 degrees, and for the resistance 8 degrees. The relative quantities of liquid were as 1 to 11. This would give as the ratio of the rises in temperature, neglecting radiation, and the difference in specific heats, $11/1 \times 65/150 = 4.8$. The actual ratio was $18/8 = 2.25$, or less than one-half as great. The difference is too great to be due to radiation. The reason is probably as follows:

In Fig. 3 the heavy line represents the difference of potential between the terminals of the interrupter, the figure being drawn for a circuit of 100 volts. The difference of potential starts at zero at the make, (assuming, as is nearly true for high voltages, that the polarization can be neglected), rises according to Helmholtz's equation, $E\left(1-e^{-\frac{Rt}{L}}\right)$, from a to b. At b the current is strong enough to cause the interrupter to act. As soon as the liquid begins to leave the platinum point, an arc forms and lasts till the circuit is entirely broken. The self-inductance of the circuit causes the potential across the break to rise probably considerably higher than the applied e. m. f., giving a cure something like $b\ c\ d$. At and during complete break the difference of potential is, of course, equal to the e. m. f. of the circuit. It is represented by de. E is the point at which the circuit is made again, and the potential, of course, falls to zero. Up to the moment of break, the current is proportional to the difference of potential or is represented by ab'. At and immediately after break, an increasing resistance is introduced, and the current falls as represented by $b'\ d'$...During complete break the current is, of course, zero or $d'\ a'$. The power wasted in the interrupter is at any instant the product of the instantaneous values of the current and the e. m. f. Thus, at the point t it would be $te' \times t\ c$. The greater part of the energy is wasted in the part $a\ b$. In $d\ e$ none is wasted, and in $b\ c\ d$, while the difference of potential is great, the current is small and the time it lasts is very short. This shows why so little power is really wasted there. The case is somewhat like that of the wattless current of an inductive resistance on an alternating current circuit. This view is supported by the fact that as the total applied voltage was varied, the current being kept the same, the drop over the interrupter varied from 20 to 100 volts, while the power lost ($I^2 R$) must be practically the same, the only possible difference being that the arc at break might be longer with the higher voltage. No difference can, however, be detected by the eye.

The maximum length of spark obtainable with various numbers of turns in series is given by the following table. The squares of the number of turns are also given and these are proportional to the self-inductance.

VARIATION OF LENGTH OF SPARK WITH SELF-INDUCTANCE.

No of Turns.	Self inductance.	Maximum Length of Spark.
10	1	6⅜″
25	6.2	6⅜″
50	25.	6¼″
75	56.2	6⅛″
100	100	5 15-16″
150	225	4¾″
175	306	4″
200	400	3¼″

Plotting the self-inductance and the spark length gives practically a straight line. If account were taken of the self-inductance of the coil it would tend to make it a little straighter. The strength of current was kept constant. The fact that the spark length increases with higher frequency indicates that the portion $b\ d$ of the curve, corresponding to the break, decreases in length as the part $a\ b$ decreases.

The interrupter will operate an induction coil equally well on an alternating current circuit. As is well known, if an alternating current of sufficient strength be passed through the primary of an induction coil, instead of the usual spark discharge, there is a high tension alternating current arc. This arc is highly calorific. It resembles a gas flame in color, and will readily ignite wood, paper, etc. If now the interrupter and the coil be connected directly in series and from 30 to 100 or more volts be applied, with the discharging rods drawn apart a few inches, a shower of sparks pass between the points. (Fig. 2.) These present precisely the same appearance as that noticed when the interrupter is actuated by a direct current.

The reproductions in Figs. 1 and 2 are from photographs taken with the coil and interrupter on the alternating current. The first was taken between points and shows the effects previously described. The other is between one-half inch balls and is much the same. The blurring of the + end of the discharge is very clearly seen, but the thickening while visible is not so plainly seen. The spark gap in both cases was six inches. The frequency used was 125 cycles per second, and any desired voltage was obtained by means of an autotransformer.

If an ordinary single focus tube be connected to the terminals, it works excellently, and presents the same appearance as with the direct current, or the ordinary vibrator. A reversal of the poles produces the ordinary result. The interrupter then, as is evident both from the spark given and the above-mentioned action of the tube, modifies in some way the shape of the current curve so as to produce a distinct polar effect at the secondary terminals. That this is not due, as has been stated, to the fact that current passes in only one direction, was shown by connecting a direct current and an alternating current ammeter in series. When the alternating current ammeter read six amperes, the direct current instrument showed only 0.3 amperes. The excess was from the platinum to the lead plate. To produce the same polarity the lead plate must be connected to the post to which the + pole of the battery would be attached. Consequently, the breaks must take place while the current is passing from the platinum to the lead plate, as we should expect from its behavior on the direct current.

The picture of the fish (Fig. 4) was taken with a single focus tube,

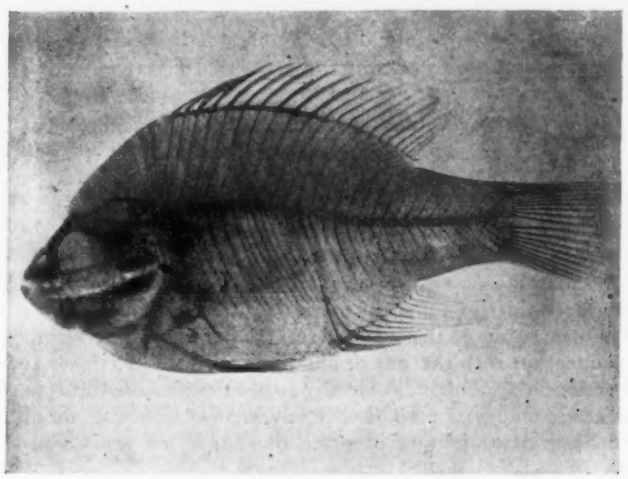


FIG. 4.—RADIOGRAPH, USING WEHNELT INTERRUPTER.

the coil working on the alternating current. The distance was eight inches and the exposure two minutes, with the coil working at about half power. One tube that we used was much like the ordinary single focus tube, except that instead of the inclined platinum plate being the anode, it was insulated, and a separate plate below it was provided for the anode. This tube worked well on the direct current with the interrupter, but gave little result with the alternating current. With a double focus tube, fair results could be obtained, but the single focus tube seemed most satisfactory. Occasionally, if the platinum point is too long for the current employed, the loud hum of the interrupter will be replaced by a crackling sound, the tube becomes violet in color, particularly at the portion just back of the anode, and the anode becomes almost instantly red hot.

Another curious phenomenon was noticed. If the discharge rods of the coil be approached to within about two inches of each other, the discharge changes suddenly. The torrent of sparks is replaced by a true alternating current arc, precisely like the one previously described. It emits a loud hum, exhibits no polar effects, and is uninfluenced by a magnet. The appearance of the light in the interrupter is unchanged. That this is a true alternating current arc was proved by the fact that its note, and that of the interrupter, agreed exactly with that of the transformer supplying the current. With 8 amperes passing, a direct-current ammeter showed 0.5 amperes in the same direction as before. This arc did not appear to be due to any resonant effect, as it could not be drawn out to more than its original formation length.

Meeting of the Pacific Coast Electric Transmission Association.

As briefly noted in our issue of July 15, the third annual convention of the Pacific Coast Electric Transmission Association was held at the Cliff House, in San Francisco, on Tuesday and Wednesday, June 20 and 21, 1899. The meeting was one of the best ever held, the papers and discussions being full of valuable material and results. The place and time of the meeting were most fortunate, and the attendance represented very fairly the electrical transmission interests of the Pacific Coast.

The first paper presented on Tuesday was one by Dr. F. A. C. Perrine, honorary member, on "Tests and Calculations for a Forty-Mile Aluminum Transmission Line." The line upon which the experimental work was carried on is the two-phase four-wire transmission line between the power house of the Blue Lakes Water Company and the City of Stockton. The tests consisted of a determination of the resistance, inductance and capacity of the entire line, the results being presented as obtained from direct experiment and from calculation. These preliminary experiments seemed to show that the results of calculation can be depended upon, within all reasonable limits, for such determinations.

The length of the line, as shown by the measurement of its resistance, agreed almost exactly with the surveyed length. The inductance also was shown to agree very closely with the results of calculation, using Kennelly's "impedance factor" formula. The experimental determination of the capacity of the line gave results which agreed very closely with the computed capacity, using the following formula:

$$C = \frac{1.11 \times 10^{-5} K l}{4 \log_e \frac{d}{r}}$$

k = specific inductive capacity (for air, unity).
l = length of conductor in centimeters.
d = distance between conductors in centimeters.
r = radius of conductor in centimeters.
C = capacity in microfarads.

The general conclusions drawn were, that for transmission lines of this length and character, the ordinary formulæ in general use will give results of sufficient accuracy for practical work.

The discussion of this paper brought out some interesting points in connection with the use of aluminum instead of copper for such transmission systems. So far as has been determined in this particular case, it does not seem that any serious difficulty should arise in the use of aluminum in place of copper for transmission systems.

The second paper presented was by Mr. John Martin, on "Electric Lighting Versus Gas." The relative cost of illumination by the ordinary incandescent light and by gas (using the ordinary burner and the Welsbach burner) was clearly contrasted in the paper; the many advantages of the incandescent lamp for ordinary illumination were brought out, as well as the small cost of illumination using the Welsbach gas burner. The paper was based in the main upon replies received from many central station managers and also from men connected with the manufacture and the sale of illuminating gas.

The discussion which followed the reading of the paper gave particular attention to the relative advantages to the central station and also to the customer of meter rates and flat rates. Other points brought out were in connection with the importance of a high efficiency incandescent lamp in any incandescent lighting system.

At the conclusion of the discussion of this paper the regular members convened in executive session, and the following officers were elected for the ensuing year: President, Prince A. Poniatowski, president of the Standard Electric Company, of California; vice-president, A. G. Lamson, president of the Salt Lake City Water & Electric Power Company; treasurer, Mr. Angus, of the Standard Electric Company, of California; secretary, George P. Low. The president later appointed Mr. C. P. Gilbert and Mr. C. N. Beal, who, with himself, compose the executive committee of the association.

On Wednesday, June 21, the meeting was called to order at 10:30 a. m. by the new president, Prince A. Poniatowski. The first paper read was one by Professor Clarence L. Cory, honorary member, entitled "The Regulation of Alternating Current Generators."

The paper explains the principles of drop in alternators as related to the factors of resistance, inductance and armature reaction. These are illustrated in the case of three machines, one having a smooth-core armature, another a slotted armature of the usual type and the third a unitooth armature, or one having a single tooth to the pole. It is shown that the first machine will have the least self-inductance while the latter will have the highest, since the coils being small in number, the number of conductors must be larger. In the second type a comparatively small number of turns are placed in each slot, the slots being small and comparatively numerous under each pole piece, and it is therefore a mean between the original smooth-core armature and the unitooth armature. Owing to the small inductance of the smooth-core armature, in the case of a short circuit, the almost inevitable result is that the conductors are stripped from the armature owing to the fact that the current through the short circuit increases far beyond its normal value. On the other hand, in the case of armatures of high self-induction, the current on short circuit will usually not exceed twice the full load current, and they may therefore be short-circuited with no danger whatever.

As to the demagnetizing effect of the armature current on the poles, this largely depends upon the power factor at which the generator is operated and also upon whether the current is a leading or a lagging one. If a leading current, the tendency is to over-magnetize the fields, while a lagging current tends to demagnetize the fields, and an alternator with practically no self-inductance in its armature and delivering current to a non-inductive circuit will have practically no demagnetizing effect on the armature. The demagnetizing effect of a lagging current is greater in an armature wound with a few coils each with a large number of turns, than in an armature with a large number of coils with a few turns each. Considering the extreme case where the current lags 90 degrees behind the generated e. m. f., if the armature is so wound as to have only one coil for every pole-piece, each coil containing a large number of turns, the current in this coil is a maximum when it is exactly opposite the pole piece—that is, when it is in position for maximum demagnetizing effect. If this coil were divided up into a number of coils of a few turns each, only a part of the original main coil is in position for maximum magnetizing effect. There is, therefore, a distinct gain as regards regulation, in favor of the distributed armature winding, or an armature winding of comparatively few turns in each coil and a large number of such coils or slots in the armature. Of course, the form of e. m. f. wave will also be affected by such a change in the armature winding. In conclusion, it is stated that the modern dynamo, whether alternating or direct, and, if alternating, whether polyphase or single-phase, should possess the five following important features: 1. A high efficiency. 2. A low temperature increase when operating at full load. 3. Good commutation (reference only being to direct-current machines). 4. Good mechanical design and construction. 5. Good regulation.

The discussion which followed the reading of the paper brought out some interesting points in connection with the use of synchronous motors or rotary converters to increase the power factor of inductive systems. The experience of many of those present, in the different electrical transmission plants of the State, made such information of particular value and of great practical importance. The increased loss in transmission lines when a given amount of power is transmitted at a low power factor was also discussed fully and received considerable practical attention.

Following this, a paper by Mr. L. A. Hicks, entitled "Electrically Driven Centrifugal Pumps," was presented. Experimental work had been carried on for some time upon centrifugal pumps, and the results were shown by curves and charts. The relation of the speed to the head of water against which such pumps must operate was discussed. The importance of electrically driven pumps for irrigation purposes, particularly at the present time, is so great that the data presented were of much value.

After the discussion of this paper, Mr. C. W. Hutton read a paper entitled "By What Method Shall we Determine a Fair Return for Current Supply?" The differential rate meter was commended very highly for the many purposes for which electrical energy is used from water power central stations. In the discussion, the desirability of developing some definite and practical method of reducing the ratio of the peak load to the average load was dealt with from the experience of the different managers present. The very great desirability of having a large power consumption during the day is apparent; and the commercial importance of a practically uniform load is one that must be considered.

On the evening of June 20 the annual banquet was held, the prin-

cipal speaker of the evening being the newly elected president. The desirability of more frequent meetings was mentioned, and during the present year it is proposed, if possible, to hold meetings monthly or bi-monthly. Among those present, by special invitation or as further representatives of members or associate members, at the banquet as well as at open meetings of the convention, were the following: Prince A. Poniatowski, president of the Standard Electric Company, of California; Mr. T. S. Bullock, general manager of the Sierra Railway Company, of California; Mr. R. M. Jones, engineer of the Salt Lake City Water & Electric Power Company and Pittsburg Reduction Company; Dr. F. A. C. Perrine, honorary member; Professor C. L. Cory, of the University of California, honorary member; Mr. R. S. Masson, superintendent of the Independent Electric Light & Power Company, of San Francisco; Mr. L. D. Hitzroth, assistant superintendent of the San Francisco Gas & Electric Company; Mr. John Mason Gardiner, engineer of the Kern-Rand Electric Company, of Los Angeles; Mr. L. A. Hicks, civil engineer, Kern County Land Company, Bakersfield; Mr. R. B. Elder, agent of the Westinghouse Manufacturing Company, Mr. H. D. Scribner, agent of the Westinghouse Electric Mfg. Company; Mr. C. E. Sedgwick, agent of the General Electric Company; Mr. Frank P. Adams, superintendent of the Stockton Gas & Electric Company; Mr. J. D. Mortimer, of the University of California.

Electrical Standardization—IV.*

INSULATION.

The ohmic resistance of the insulation is of secondary importance only, as compared with the dielectric strength, or resistance to rupture by high voltage.

Since the ohmic resistance of the insulation can be very greatly increased by baking, but the dielectric strength is liable to be weakened thereby, it is preferable to specify a high dielectric strength rather than a high insulation resistance. The high voltage test for dielectric strength should always be applied.

INSULATION RESISTANCE.

Insulation resistance tests should, if possible, be made at the pressure for which the apparatus is designed.

The insulation resistance of the complete apparatus must be such that the rated voltage of the apparatus will not send more than

$$\frac{1}{1{,}000{,}000}$$

of the full load current, at the rated terminal voltage, through the insulation. Where the value found in this way exceeds 1 megohm, 1 megohm is sufficient.

DIELECTRIC STRENGTH.

The dielectric strength or resistance to rupture should be determined by a continued application of an alternating e. m. f. for one minute. The source of alternating e. m. f. should be a transformer of such size that the charging current of the apparatus as a condenser does not exceed 25 per cent. of the rated capacity of the transformer.

The high voltage tests should not be applied when the insulation is low, owing to dirt or moisture, and should be applied before the machine is put into commercial service.

It should be pointed out that tests at high voltages considerably in excess of the normal voltages are admissible on new machines, to determine whether they fulfil their specifications, but should not be made subsequently at a voltage much exceeding the normal, as the actual insulation of the machine may be weakened by such tests.

The test for dielectric strength should be made with the completely assembled apparatus and not with its individual parts, and the voltage should be applied as follows:

1st. Between electric circuits and surrounding conducting material, and,

2d. Between adjacent electric circuits, where such exist, as in transformers.

The tests should be made with a sine wave of e. m. f., or where this is not available, at a voltage giving the same striking distance between needle points in air, as a sine wave of the specified e. m. f., except where expressly specified otherwise. As needles, new sewing needles should be used. It is recommended to shunt the apparatus during the test by a spark gap of needle points set for a voltage exceeding the required voltage by 10 per cent.

*Report of the Institute Committee on Standardization of Generators, Motors and Transformers.

A table of approximate sparking distances is given in an appendix, which will be printed in a succeeding number.

The following voltages are recommended for apparatus not including transmission lines or switchboards:

Rated Terminal Voltage.					Capacity.	Testing Voltage.
Not exceeding 400 volts					Under 10-kw	1000 volts.
" " "					10-kw and over	1500 "
400 and over, but less than 800 volts					Under 10-kw	1500 "
" " "					10-kw and over	2000 "
800 "	"	1200	"		Any	3500 "
1200 "	"	2500	"		Any	5000 "
2500 "					Any	Double the normal rated voltages.
Synchronous motor fields and fields of converters started from the alternating current side						5000 volts.

Alternating field circuits should be tested under a breakdown test voltage corresponding to the rated voltage of the exciter, and referred to an output equal to the output of the alternator; i. e., the exciter should be rated for this test as having an output equal to that of the machine it excites.

Condensers should be tested at twice their rated voltage and at their rated frequency.

The values in the table above are effective values or square roots of mean square, reduced to a sine wave of e. m. f.

In testing insulation between different electric circuits as between primary and secondary of transformers, the testing voltage must be chosen corresponding to the high-voltage circuit.

In transformers of from 10,000 volts to 20,000 volts, it should be considered as sufficient to operate the transformer at twice its rated voltage, by connecting first the one, and then the other terminal of the high-voltage winding to the core and to the low-voltage winding. The test of dielectric resistance between the low-voltage winding and the core should be in accordance with the recommendation noted above for similar voltages and capacities.

When machines or apparatus are to be operated in series, so as to employ the sum of their separate e. m. fs., the voltage should be referred to this sum, except where the frames of the machines are separately insulated both from ground and from each other.

How the Volta Exposition Was Destroyed.

Some details have reached this country as to the manner in which the interesting Volta Centennial Electrical Exposition at Como, Italy, was destroyed on July 8. It appears that flames were discovered in one of the galleries of the silk department at 10 o'clock in the morning, in the neighborhood of one of the large electrical machines belonging to the exhibit of the royal navy, which was in operation at the time, and a large flying spark from which is alleged to have been the cause of the disaster. All efforts made by the guard of firemen to quench the spreading flames were impeded by the wild panic among the visitors, and by the time the space was cleared the long gallery was in a blaze, the bales and loose pieces of silk, brocades, etc., catching the fire like tinder. In a few minutes the flames had reached the rooms of the adjoining electrical exhibit and the neighboring house containing the precious relics of Alessandro Volta. Every effort to rescue the priceless instruments and apparatus of the great inventor proved fruitless, and in a few seconds they were lost in the blaze. Meanwhile the fire had spread to all the remaining parts of the great buildings, and the bursting of the boilers in the machine department added a new terror to the scene.

In an hour's time the entire exposition grounds were one red-hot furnace. Despite the combined strength of the fire companies, and the deluge of water thrown on the flames, the fire raged all day. As soon as the ungovernable nature of the fire in the main buildings became evident every effort was directed to save those of the Exposition of Sacred Art, and of the Industrial Arts, separated from the electrical division by the large carriage drive running through the grounds. These efforts were more successful, and the flames were prevented from making any serious headway in this new direction. No lives were lost. A great part of the exhibits were not insured.

The exposition was opened with great celebrations on the 20th of May, by King Umberto and Salandra, the Minister of Commerce and Agriculture. Messages of congratulation were sent from this

country by the New York Electrical Society, the National Electric Light Association, and the New York Electrical Exhibition. The concourse of visitors from all parts of the globe has been a constant and large one, and in the forty-nine days of its existence the exhibition had already showed itself to be a great success, when it was thus prematurely brought to such a disastrous end.

Besides the various instruments used by Volta in his many experiments, and which had been sent to the exhibit by the Institute of Science and Letters of Milan, the University of Pavia, and the Civic Museum of Como, almost all Volta's autograph letters, his books, correspondence, and a perfect library of works on electricity, from the days of its infancy to the present time, succumbed to the flames.

CURRENT NEWS AND NOTES.

CABLE FROM AUSTRALIA TO SOUTH AFRICA.—Advices from Melbourne, Australia, are to the effect that the Eastern Extension Telegraph Company has made an offer to the Victorian government to lay a cable from Australia to South Africa without cost to the colonies. The company asks neither subsidy nor guarantee.

CORPORATION TAXES IN SOUTH CAROLINA.—The Bell Telephone Company and other corporations have, according to press despatches, acquiesced in the valuation for taxation fixed on their properties by the Railroad Board of Equalization in South Carolina. The Western Union Telegraph Company, which was taxed for $1,000,000, protested. This is the first time that these properties have been taxed in this manner in South Carolina.

GENERATING POWER BY TIDES.—At Pont-L'Abbé, Finisterre, France, the tides are utilized during fourteen hours per day in generating power. At flood tides, the water flows through a canal two and a half miles inland, into a pond in rear of the power house receiving the water, which returns to the sea at ebb tide. The total fall is from 6½ to 7½ feet, and 80-hp are generated by means of turbines. It has been proposed to apply this means to generate electric power for industrial application.

THE WOODS OF VINCENNES.—The new electric railway in Paris will do much to familiarize visitors to that city next year with the beautiful suburbs of that city and probably enable many of them to reside "outside the bulwarks" of the octroi district. Meantime attention is being paid to the electric lighting of the Bois de Boulogne, and also of the Bois de Vincennes, which is to have an equal number of lights. The arcs will be placed, in the Vincennes Woods, at a distance of 50 metres from one another.

EXTRAORDINARY LIGHTNING FATALITIES.—The last month has seen a great many records of death and damage from lightning, but one of the most startling episodes is that reported from Germany. A special despatch of July 24 from Berlin says: During a thunderstorm yesterday forty persons who were leaning against a wire railing at the Charlottenburg cycle track were struck by lightning. Three were killed and twenty were severely injured. It is stated that the scene was indescribable from the horror and consternation caused by this terrible visitation.

ELECTRIC TRACTION IN BELGIUM.—The Belgium government will soon put in service its first state electric line—between Mons and Boussu, a distance of about seven miles. The equipment will consist of twelve motor cars and twelve trailers. Proposals are asked for the operation of the line for two years, the state furnishing current at 2.4 cents per kw-hour and maintaining the roadbed, buildings and power house apparatus, and supplying the employees. The contractor is to keep in repair the cars, motors, line and bonds, see to the lighting of the stations, and guarantee a maximum mileage of 140,000 train miles per year, each train to consist of two cars.

DENVER TROLLEY POLITICS.—The City of Denver has recently witnessed a red hot fight between the Denver Consolidated Tramway Company and its opponents, with the result that a new ordinance has lately gone through the City Council. In less than five minutes after the passage of the bill it was signed, and now Denver claims the right to organize an independent company that will comply with the city ordinances. One is already in the field to take up the rights of way in which the old tramway company grants have only five years to run. This company proposes to pay the city 5 per cent. on its gross earnings, and to assume the trackage of the tramway at a valuation to be fixed by a board of appraisers.

BRITISH TRAMWAYS ASSOCIATION.—The necessity for an efficient national body to represent the tramways and light railways of England is said to have been severely felt for some time, and now it is proposed to form the Tramways and Light Railways Association. The articles provide for a governing body of a president, vice-president and a council of not less than eighteen members. The first members nominated for the council are such well known men as Messrs. G. Richardson, G. F. Fry, E. Garcke, J. Barber Glenn, W. M. Murphy and Stephen Sellon. Mr. A. Wilcox has been appointed honorary secretary and Mr. William Morris, Jr., honorary solicitor. The annual dues for companies are five guineas and for individuals one guinea, each member having one vote and each company five votes. One-third of the council is to be retired each year.

DESTRUCTION OF VOLTA RELICS.—But few of the priceless relics associated with the name of Volta were saved from the buildings of the Volta Centenary Exposition which were destroyed at Como, Italy, July 8. Among the articles saved was one of Volta's early piles, about twenty manuscripts and a few of his letters and a few books that had belonged to his library. An irreparable loss was that of his laboratory notes and scientific correspondence. In the accounts of the destruction of relics the first electrophorus and first absolute electrometer are not mentioned among the articles saved. Among other losses were a number of Ferraris' models and some of his manuscripts and diplomas. Among the former was the first model of the rotary field. This is presumably the same that in 1893 was forwarded to the Chicago Exposition by a vessel which was sunk in the harbor of Genoa, but subsequently raised and the model recovered and sent to Chicago, where it was exhibited.

IMPORTS OF MANUFACTURING MATERIAL.—Articles required in manufacturing, and foodstuffs not produced in the United States form the largest items of the increase in importations shown by the fiscal year just ended. The Treasury Bureau of Statistics has prepared a statement covering all articles or classes of articles in which the importation increased or decreased as much as $1,000,000 during the year. This statement shows an increase of importations in nearly all articles of foreign production required by our manufacturers. Unmanufactured fibres, raw silk, crude rubber, bar and block tin, hides and skins, undressed furs, cabinet and other woods, unmanufactured tobacco and chemicals for use in manufacturing, all show a heavy increase, wool being the only important item of material for the factory which shows a reduction in imports. In the ten great classes of material imported for use of the manufacturers, fibres, silk, rubber, hides, furs, tin, copper, tobacco, wood and chemicals, the increase amounts to about $30,000,000, though the reduction of several million dollars in wool brings the net increase in manufacturers' materials to something less than that figure. Among manufactured goods, the finer grades of cotton, silk and fibres show the largest increase, though matting, china ware, dressed furs and spirits are slightly in excess of last year.

NATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.—A meeting of the entertainment committee of the Board of Trade of Wilmington, Del., was held in the parlors of the Clayton House on July 20. The meeting was a large one and was held for the purpose for further arranging for the coming convention of the National Association of Municipal Electricians. Chief of Police Dolan and Fire Chief Sasse were present at the meeting, and stated that there will be a fire and police review on the afternoon of Sept. 6 at 4 o'clock. President Aydon reported that he had sent out the final invitations, and the replies he had received point to a large attendance. Pyle's Cycle Academy, which has been secured for the electrical exhibit, has been blocked off and the spaces on the floor sold to various electrical companies. The spaces are all taken. Besides the electrical novelties there will be automobiles, moving pictures, electrical cooking utensils and other exhibits which will be enumerated at a later date. The convention will meet at 10 o'clock on the morning of Sept. 5, and will hold until the police and fire review on Sept. 6. About two weeks before the convention the reception and entertainment committees will meet and complete the arrangements for the entertainment of the members of the convention and of other guests. President Aydon is sparing no trouble or expense to make the affair a success and is assisted by the Board of Trade and the Police Commission.

ANOTHER SWISS MOUNTAIN LINE.—It is proposed to extend the Viège-Zerwatt electric mountain line from Stalden, one of its stations, to Saas-Feé, a distance of ten miles, crossing in its course the valley of the Viège and ascending the Lohmatten. Racks will be employed where the grades exceed 25 per cent. The total cost of the extension of this road is estimated at $700,000.

LONG DISTANCE TELEPHONY IN FRANCE.—Through a recent governmental regulation, Bordeaux, St. Etienne, Orleans, Lille, Lyon, Rouen, Havre and several other cities in France will be enabled to communicate, via the Paris exchange, with cities having lines to the capital, but only at certain hours of the night. The maximum charge for the unit of conversation is not to exceed 60 cents.

WIRELESS TELEPHONY.—According to a London despatch, Dr. Peter Steins, a Russian, is in England introducing a system of wireless telephony invented by himself. He says that it is as successful as the wire system and that voices can be recognized at long distances. He proposes to experiment with his system between England and Belgium, and declares that it is feasible to use it between England and the United States across the Atlantic Ocean.

PROF. CHANDLER HONORED.—Prof. Charles F. Chandler, of Columbia University, has been elected president of the Society of Chemical Industry of England. Dr. Chandler has served as chairman of the New York section of the society, and is the first American to be elected president of an English scientific society. Prof. Chandler pursued his chemical studies at the Universities of Goettingen and Berlin. He was Professor of Chemistry at Union College before he was twenty-one years old, and in 1864 he founded the School of Mines of Columbia University. He accepted the Chair of Chemistry in the College of Pharmacy of New York in 1865, and is still Professor of Organic Chemistry in that institution.

NEW STORAGE BATTERY PLATE.—In a patent granted July 18 to Charles W. Kennedy, a storage battery plate is described consisting of strips of lead tape with grooved ends which engage with bars cast in a holder. The holder as illustrated has three horizontal and the same number of vertical bars, thus forming a grid with nine apertures. The tape has its surface roughened, is cut into the necessary length and the ends grooved. The apertures are not wholly filled with these strips in order to allow of their rearrangement when oxide is formed in charging, which causes them to take up all the space. In inserting the strips to engage the bars of the grid or holder by means of the grooved ends, they are placed horizontally in one aperture and vertically in the adjoining ones, thus avoiding buckling, warping or any distortion of the electrode.

EXTENDING THE THIRD-RAIL ELECTRIC SYSTEM IN MASSACHUSETTS.—Regular train service on the third-rail electric system was inaugurated on the Braintree-Cohasset branch of the New York, New Haven & Hartford Railway on July 24. In speaking of the event, Col. N. H. Heft, supervisor of the electrical department of the company, said: "We regard the opening of this system as one of the most important ventures in many years. We intend to draw regular passenger trains on the Cohasset-Braintree branch, hauling as many as eight or ten cars if necessary. The length of the new branch, twelve miles, will furnish a thorough test of the third-rail system and the result of the experiment will determine whether this system will be introduced on many other branches of the New York, New Haven and Hartford Road."

NEW FRENCH SCIENTIFIC REVIEW.—The first number has appeared of *Le Mois Scientifique et Industriel,* published monthly at 33 Boulevard des Batignolles, Paris, France, which will contain a digest of the scientific and technical periodical literature of the world, in this respect resembling somewhat the admirable English *Science Abstracts,* but covering a wider ground. Each number will also contain an original article from an authoritative pen, that in the current issue being on a new process of working gas engines, by M. Dutreaux; for the succeeding issue an article by Prof. Blondel is promised on the history of wireless telegraphy. In addition, there are notes on new books and on trade bulletins having a technical value. The matters treated are the physical branches, including electricity, and their applications; chemistry and the chemical industries, including metallurgy, dyeing, distilling, sugar making, etc.; the mineral industries; mechanics and the mechanical industries; agriculture. The staff of abstractors comprises specialists in all of the branches treated, their initials being appended to the respective abstracts. The first number contains 80 pages and several hundred abstracts, some of which are accompanied by illustrations, and all bear evidence of having written with much care.

PREVENTION OF SPARKING ON MAKING OR BREAKING CIRCUIT.—A patent was issued July 18 to Adolph Muller, of Hagen, Germany, for a method of preventing sparking on making and breaking circuits, consisting in the employment of electrolytic cells. Elements suitable for this purpose may consist of steel plates immersed in a potash lye, platinum or lead plates in sulphuric acid, or aluminum plates in an alum solution. Such a battery is immediately polarized on entering a circuit to the tension of the current therein, so that current no longer flows and thus permitting the circuit to be broken without sparking. The switching arrangement is such that the battery is first inserted into the working circuit in parallel with a portion of the latter; a further movement of the switch cuts out this portion, the battery circuit being thus substituted for it. The polarized cells reduce the current to zero, and the final movement of the switch breaks the circuit without sparking. It is stated that this method can also be used for breaking alternating currents, as the polarization batteries can be given such a small capacity that their e. m. f. will follow those of the current course quick enough to always balance them. One of the applications described is an automatic method of charging in parallel by successive contacts, groups of storage batteries, the groups being discharged in series. A device is also described for transforming by this method alternating current into direct current.

INCANDESCENT LAMP PATENTS.—A patent issued July 18 to Andrew H. Miller describes an incandescent lamp having a filament in two sections and with external connections so arranged that but one filament may be used, or the two in parallel or in series, thus giving a range of three candle powers. The filament may be practically continuous, or a double filament used. The change from one candle-power to the other is effected by simply turning the bulb in its socket, the lamp being switched on or off in the same manner. On the same date a patent was issued to Adolphe Wierre, of Paris, France, for a method of manufacture of incandescent lamps whereby it is claimed the hand labor is decreased and all of the parts of the bulb may be utilized when an old lamp is supplied with a new filament. The mouth of the neck of the bulb is metallized and inserted into a circular groove in the base, the two parts being then united by the fusion of a material contained in the groove. To put in a new filament, the base is unfused from the neck of the bulb, and after the new filament is in position, the above operation is repeated. A patent was issued on the same date to Charles G. Perkins on an improvement in the manufacture of key sockets, consisting of so forming the contacts engaged by the switch blocks when the circuit is closed, that they may be readily adjusted in order that the key shall turn easily, a firm contact be established and such a separation of parts provided that sparking will be minimized.

DEVELOPMENT OF THE KERKA WATERFALLS IN DALMATIA.—The Venetian Electro-Chemical Company has recently contracted with Antonio Supuk & Son, of Sehnico, for 1800 electrical horse-power for twenty years at $20 per horse-power per year. Messrs. Supuk & Son are owners of a portion of the famous falls of the Kerka in Dalmatia, a small amount of power having already been developed and used to illuminate the town of Sehnico and furnish current for a small calcium carbide factory (the first one in Austria) using Siemens & Halske furnaces. The negotiations were carried on through the banking house of Giulio Levi, of Triest. As a result of this deal Supuk & Son will erect a new power station to contain at first three 1000-hp units. More machinery will be put in as the demand for power increases, and this cannot fail to come about very shortly, as this water power is probably the most advantageously situated of any in Europe by reason of its proximity to the sea. A few hundred feet from the proposed new station, and placed directly on the water to facilitate the lading of ships, will be the new factory of the Venetian Electro-Chemical Company. Three-phase current will be delivered by the central station and transformed at the factory by 250-kw transformers and delivered to the furnaces at 45 volts. It is expected that the plant will start up in the beginning of 1901. The design and the general superintendence of the work is in the hands of Joseph Sartori, professor of electrotechnics in Triest.

AUTOMOBILE NAMES.—A number of correspondents have been favoring the *New York Times* with suggestions of new names for automobile. "Goalone" is not so bad, but "bile" pronounced "beel" is not inviting. A third suggestion is "tommy."

WIRELESS TELEGRAPHY IN ALASKA.—An application for a charter to build a wireless telegraph from Lake Bennett, Alaska, to the Canadian Pacific Railway in British Columbia, has been made by W. W. Anderson and A. E. Porter, of Bennett.

AUTOMOBILE'S FAST TIME.—A special despatch from Paris of July 24 says: The automobile race around France, in which great interest was taken, was finished at St. Germain this afternoon. The winner was M. De Knyff, a Belgian, who, with a 16-hp machine, covered the distance in 44 hours 44 minutes, an average of 31 4-5 miles per hour. The course in many parts was hilly and sometimes mountainous, including ascents exceeding 3000 feet. There were sundry accidents to the thirty-four vehicles that started.

SURVEY FOR A PACIFIC CABLE.—The British survey steamer Egeria has arrived at San Francisco from Esquimault, B. C. The English and Canadian governments are to establish a cable between British Columbia and Australia, which will touch at Samoa and Hawaii, and the Egeria is now engaged in the work of surveying the route. She will go from here to Honolulu, taking soundings on the way, and after coaling there will proceed to Apia. From Apia the soundings will be taken to the nearest point of Australia.

A BIG POWER PLANT FOR BUFFALO.—The International Traction Company contemplates the building of a large fireproof street car manufacturing plant in Buffalo. It is stated that options have been secured on several pieces of land in the northern part of the city for a site, and that architects and engineers are now at work on plans for the buildings and necessary machinery. It is thought that the shops will be ready for occupancy early next year. The company is planning to turn out 300 of the latest improved cars next spring. Mr. W. Caryl Ely is president of the comapny.

COAST AND GEODETIC SURVEY.—Scientific men are manifesting much interest in the preparations now making by the Coast and Goedetic Survey, which is charged with the magnetic survey of the United States for determining accurately the deviation of the compass at sea. Recent accidents at sea and the severe competition of ocean liners have called attention in a striking way to the need of accurate values of the deviation of the compass needle at sea. The values of the deviation of the needle generally used are almost wholly dependent on the observations made on land, and little has been done by the United States to secure observations at sea. The vessels of the Coast Survey are being fitted with special magnetic instruments for these observations, and it is hoped that within a very short time the survey may be able to furnish values of the magnetic variation at sea nearly equal in accuracy to those on land.

AUTOMOBILES AND PARLIAMENT.—A London cable despatch mentions the following funny and suggestive incident: Notwithstanding the fact that up till now oil motors have been most in favor here, the only member of Parliament who has tried any other than an electric motor is the Hon. John Scott-Montagu, and he had a funny experience the other night. He was on his motor when he was promptly stopped at Palace Yard by the policeman on guard. Mr. Scott-Montagu protested and pointed out that Sir. Manuel Montagu, Mr. J. H. Dalziel and others ran regularly right through the yard on their motors. "Oh, yes," said the policeman, "but they were electric motors!" while the Honorable John's was oil. The Honorable John was staggered. He had to get off, walk and go to inquire elsewhere the reason of the boycotting of oil. The fact is that his motive power was spirit, but oil or spirit was all the same to the guardian of the House. The only explanation afforded was that an oil motor had flared up near the House of Commons lately, and the Office of Works forbade such machines ever to enter the gates for fear the Houses of Parliament might catch fire.

CANADIAN NIAGARA POWER.—An important announcement in connection with the Niagara power development was made public on July 22 by Vice-President Rankine, of the Niagara Falls Power Company. He said that an amendatory agreement between the Commissioners of Queen Victoria Niagara Falls Free Park, acting for the government of the Province of Ontario, and the Canadian Niagara Power Company, was executed on July 15. This agreement was authorized by the act of Parliament passed in March last, and by its terms the time within which the Canadian Niagara Power Company must have 10,000-hp developed in Victoria Park is extended to July 1, 1903. The new franchise is for 110 years, and the annual rental has been reduced from $25,000 to $15,000. There are other amendments to the agreement in regard to the location of the plant and power house, all the plans for which have now been approved. The Canadian Niagara Power Company has yielded its exclusive right to the use of the waters within the Canadian Free park, and the Commissioners of that possession are at liberty to deal with other companies for the development of power outside the territory occupied by the Canadian Niagara Power Company.

POSTAL AUTOMOBILES.—Postmaster Van Cott, of New York, when asked about the proposed appropriation to be asked for by the Post Office Department from the next session of Congress, for automobiles for use in collecting the mails, said that he had heard nothing officially about it, but the matter had been the subject of many talks between him and Assistant Postmaster General Heath. "I have no doubt that automobiles will be substituted for all mail wagons in New York City, sooner or later," said the Postmaster. "I should like to see it done speedily, because I believe it would effect a great saving in time and a saving in expense." George C. Travis, who has the sub-contract from the government for the mail wagon service in New York City, said that he had heard nothing of the substitution of automobiles for horse wagons. "It will eventually be done," he said; "possibly within two or three years. My contract holds for two years yet, however, and it is not likely that any change will be made until its expiration. The government may conduct some experiments with automobiles here independently, or might ask me to make them, which I should be perfectly willing to do under a fair arrangement. I believe that even now, with the present high prices automobiles might be operated with a saving in expense."

MECHANICAL DRAFT.—The argument is sometimes advanced against the use of forced draft instead of induced draft that it burns out the grates, seriously injures the boiler, and blows gas and smoke from the fire doors. The basis of this opinion lies in the experience of some engineers with plants equipped with fans operated at far above the proper speed. This is usually the result of installing—through ignorance—a fan too small for the work, and then forcing it above its normal speed in order to secure the required air volume. As a consequence, instead of creating an ash pit pressure of ¾ to 1¼ inches, which is all that is ordinarily required, the pressure is forced up to even 5 or 10 inches, with the attending objectionable results. In a recent instance, an engineer complained of gas discharged from the fire doors with incidental effects, and condemned forced draft in toto, although he was favorably disposed toward induced mechanical draft. Investigation showed that the fan was being operated at about 12 inches water pressure, which, it is needless to say, accounted for all the trouble. When forced draft is used, the air as it passes from the ash pits to the combustion chamber is greatly reduced in pressure, owing to the resistances of the grates and the fuel. Coincidently, the stack, even if a short one, tends to produce a partial vacuum in the furnace. As a result, it is practically impossible to create under proper conditions more than a slight excess of pressure in the combustion chamber, and this should not be enough to force the gases out at the fire doors.

LETTERS TO THE EDITORS.

Wireless Telegraphy.

To the Editors of Electrical World and Engineer:

Sirs:—Has any attempt at Marconi telegraphy been made by the use of the iron tubing in gas or artesian wells? This tubing extends in continuous lengths sometimes as deep as 2000 feet in the ground, and it would seem that very interesting, even if not successful, experiments might be tried, using these casings instead of the aerial wire, or in connection with it. Apparently some work under water has been done successfully.

BUCKNER SPEED.

NOGALES, A. T.

Lodge Wave Telegraphy.

To the Editors of Electrical World and Engineer:

Sirs:—As an illustration of the varying idiosyncracies of apparatus, I would say that whilst Mr. Adams, in the experiments described by your issue of July 15, found that he could not cut out the waves (I call them Lodge waves, for Lodge was the first to produce and experiment with waves sliding along conductors) with inductances, yet I have for the last six months been using the following apparatus, where *T* is a Thomson air-core transformer, the primary of which is connected in series with the wire from mast to ground

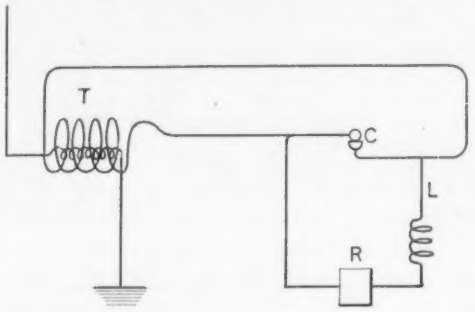


DIAGRAM OF FESSENDEN CIRCUIT.

and the secondary is connected to the coherer; C, a coherer; R, relays and battery, and L, an inductance. I find I get much better results this way, depending upon the ratio of secondary to primary turns. The primary has to be adjusted.

Possibly the reason for the difference in results is that I am using an arrangement which cuts off the purely electrostatic effects and only get the wave effects. I have not tried sending any distance, as I was experimenting on coherers, but the method should be useful for this.

REGINALD A. FESSENDEN.

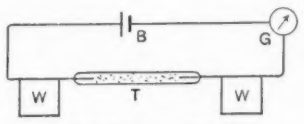
ALLEGHENY, PA.

Coherer Action.

To the Editors of Electrical World and Engineer:

Sirs: While experimenting with wireless telegraphy apparatus, I noticed that the resistance of the coherer was reduced if it was short-circuited for an instant, and that the resistance rose again upon tapping the tube. In fact, short-circuiting the tube had the same effect exactly as if a wave from the transmitter had struck it.

The coherer in this case was composed of a glass tube filled with iron and brass filings, wires being pushed into the interior to act as electrodes. Referring to the accompanying figure, T represents the coherer, W, W, tinfoil wings, B, the battery and G, a galvanometer. Now, when W, W, were connected with a wire for an instant, the galvanometer needle swung over and remained over until the tube was jarred, when it fell to zero again.



COHERER ACTION.

On placing a non-inductive resistance in place of G, short-circuiting and then substituting G for the resistance, it was found that the coherer resistance was lowered, but not so much as if the galvanometer was in circuit in place of the non-inductive resistance at the time of short-circuiting.

I then used a long wire to short-circuit, but the effect was the same as with a short wire. On passing a current of about 5 amperes through a wire held near the tube and interrupting the circuit, no effect was obtained. I shall be very glad if some of your readers will furnish an explanation of the actions noted.

R. W. SHOEMAKER.

PASADENA, CAL.

Zengel Method of Shunt Excitation.

To the Editors of Electrical World and Engineer:

Sirs.—Replying to your favor of June 9, concerning the practical operation of my method of shunt excitation, I wish to state that the German patent, No. 101,432, covering the method, has passed into the hands of the *Allgemeine Electricitäts Gesellschaft*, of Berlin. As soon as practical results are obtained from experiments now being conducted with dynamos and motors to which the method is applied, I shall take pleasure in communicating the same to you.

In reference to the alternating current losses, I can give you the following information at the present time. In a number of experiments on several machines, simultaneous readings of a wattmeter and a continuous current ammeter and voltmeter were made, and it was found that the wattmeter indications were 5 per cent. higher than the values calculated from the ampere and voltmeter readings. These measurements, undertaken with a great variety of frequencies, lead to the conclusion that the iron losses occasioned by the alternating portion of the current do not exceed 5 per cent. of the entire exciting energy. The machines employed had capacities up to 10-kw. I presume that in larger machines the losses due to the iron in the poles will be correspondingly smaller. Evidently the losses will also be reduced considerably if the poles are constructed of laminated iron.

I also noticed a small error in the article on the method which appeared in your columns. It should not read that the shunt resistance is redueed to ¼ of its former value by employing those connections, but that the resistance is reduced only to ½.

DARMSTADT, GERMANY. A. SENGEL.

[In the last statement of the above letter, Prof. Sengel appears to be in error. Any machine must require as many ampere-turns for its excitation when its field is supplied at one voltage as when it is supplied at any other. If the voltage impressed upon the shunt circuit is reduced 50 per cent., as in the case of the Sengel connection, then, the field coils remaining of the same volume, the wire must be of half as many turns and have twice the cross section of the original windings. The resistance will then be reduced to one-fourth its former value, which, with half the former voltage, will give twice the former current, through half as many turns, or there will be the same number of ampere turns and the same consumption of energy. If, as Prof. Sengel states, the resistance is only reduced 50 per cent., then, the coil remaining of the same volume, the cross section of the wire will be increased about 40 per cent. and its number of turns reduced about 30 per cent.; the current flowing would remain the same with the reduced resistance and voltage, and the ampere turns would be reduced 30 per cent. As Prof. Sengel's connection could by no possibility give a higher magnetizing effect per ampere turn, the machine would not excite itself to full voltage if so arranged.—Editors.]

Electrical Energy from Carbon.

To the Editors of Electrical World and Engineer:

Sirs:—The very interesting and elaborate experiments described in the recent Royal Society paper of Mr. Willard E. Case, and published in the ELECTRICAL WORLD AND ENGINEER, July 22, instead of proving the possibility of obtaining electrical energy without heat from the galvanic oxidation of carbon, seem rather to confirm the theoretical impossibility of obtaining electrical energy from carbon by the reaction he alleges to occur. An inspection of the equation representing this reaction, as given by Mr. Case, shows conclusively, first, that the energy theoretically available as electrical energy is less than 13 per cent. of the quantity of energy in the carbon consumed; and, secondly, that even this small quantity of electrical energy does not come from the carbon, but from the other reagents taking part in the chemical reaction.

The formation heats concerned in this equation, as given by Naumann, on the assumption that the CO_2 is forced in solution, are as follows:

$$\underset{}{C} + \underset{510{,}840}{2Fe_2Cl_6} + \underset{136{,}720}{2H_2O} = \underset{102{,}840}{CO_2} + \underset{399{,}800}{4FeCl_2} + \underset{157{,}280}{4HCl}.$$

The CO_2 is formed by oxygen derived from the decomposition of $2H_2O$. The energy required to separate the oxygen from $2H_2O$ exceeds that evolved by the oxidation of the carbon by 136,720 — 102,840 or 33,880 calories. The energy liberated by the formation of 4HCl (157,280) and by the solution of the CO_2 (5880) supplies this deficit besides the 111,040 calories required to reduce the $2Fe_2Cl_6$ to $4FeCl_2$, leaving a surplus of 12,360 cal. This 12,360 cal., furnished by the 4HCl and the solution of the CO_2, is the only available energy of the reaction. It is only $\frac{12{,}360}{96{,}960} = 12.7$ per cent. of the

quantity of energy contained in the carbon oxidized, and the maximum theoretical e. m. f. it could give in this reaction is $\frac{12,360}{4 \times 23,240}$ = 0.133 volt.

The fact that Mr. Case obtained experimentally an e. m. f. of 0.25 volt, or double the highest possible theoretical value, may be taken as conclusive proof that the chemical reaction stated by him is not the cause of the observed electromotive force. To make assurance doubly sure on this point, Mr. Case states that he obtained even a higher e. m. f. when he substituted for the carbon a second electrode of platinum. Here was the carbon cell without the carbon giving better result.

The fact shown by Mr. Case that an electro-chemical cell having considerable e. m. f. may be constructed with two similar electrodes, is not to be questioned, it having been shown by Faraday, Grove, Tommasi and many others. The writer has also called attention a few times in the columns of this journal to the fact that such cells may be constructed having an electromotive force of nearly two volts.

The fact shown by Mr. Case that ferrous chloride is easily oxidized to ferric chloride by atmospheric oxygen is well known to chemists. The heat wasted in such a regenerative reaction, corresponding to the alleged electro-chemical reaction of Mr. Case, is 90,480 cal., or 7.3 times the energy theoretically available as electrical energy.

Mr. Case's researches appear to show for the first time that carbon in certain forms (if his material proves to have been pure carbon) has a reducing action on ferric chloride. Whether this reaction really produces CO_2 does not seem to be clearly shown. Mr. Case is either not careful to state or careful not to state the precise operations by which he collected and identified the CO_2. Its existence seems to be rather inferential, though he weighed it or something else that weighed about what the CO_2 ought to have weighed.

Taking into consideration the fact that the chemical reaction given by Mr. Case could not possibly have caused the high e. m. f. he observed, it would seem that the actual formation of CO_2 needs confirmation, unless Mr. Case will publish in detail the method used in identifying the CO_2. There is nothing in his paper to show, for instance, that what he weighed as CO_2 could not have been H_2O. It appears from the paper that Mr. Case got his best and most practical results from the battery that contained no carbon, and that he calculated from the 7.5 ampere-hours thus obtained the quantity of carbon that would have been consumed if he had used carbon instead of platinum.

CHARLES J. REED.

PHILADELPHIA.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

By CARL HERING.

DYNAMOS, MOTORS AND TRANSFORMERS.

REFERENCES.

Efficiency Tests of Dynamos.—RICE.—An illustrated article, of an elementary nature, on dynamo tests for efficiency.—*The Eng.*, May 1.

Testing Dynamos.—DETTMAR.—A short reply to the communication of Fischer-Hinnen (Digest, June 24). He still disagrees with the statement that the friction loss at a constant speed increases with the excitation.—*Elek. Zeit.*, June 29.

Single-phase Induction Motors.—STEINMETZ.—The first part of an article on the theory and calculation of the single-phase induction motor.—*Elek. Zeit.*, June 22.

Alternating-Current Dynamos and Transformers.—ADAMS.—Three illustrated elementary articles on alternating-current generators and transformers.—*The Eng.*, May 15, June 15, July 1.

High-Speed Continuous Current Transformer.—SCOTT.—A reprint of the article abstracted in the Digest July 15.—*Elec. Rev.*, July 12.

Currents of Different E. M. F. from one Dynamo.—MILIUS.—A short illustrated article on some applications of the principle of generating currents of different e. m. fs. in one multipole dynamo, by exciting the pairs of poles to a different degree, without connecting the brushes with one another.—*Elec. Tech.*, June 15.

Dynamos for Electrotyping.—Three short communications on the question of what type of dynamo is advisable for general electrotyping and electroplating work, and what voltage it should be designed to give.—Lond. *Elec. Eng.*, July 7.

Dynamos.—ADAMS.—An illustrated elementary article on dynamo and engine capacities.—*The Eng.*, March 1.

Boosters.—CANFIELD.—An illustrated article on the use of boosters in street railway service.—*The Eng.*, July 1.

LIGHTS AND LIGHTING.

REFERENCES.

Train Lighting.—ROSS.—An article on the various systems of train lighting by electricity.—*Can. Eng.*; reprinted in *Ry. and Shipp. World*, February.

Miner's Lamp.—A tabular comparison of fourteen different forms of lamps, giving the weights, dimensions, candle-power, etc. In three of these electricity from a storage battery is used; the advantages of the latter are pointed out.—Lond. *Elec. Eng.*, July 7.

POWER.

Power from Windmills.—CRANDALL.—An illustrated paper presented to the American Association for the Advancement of Science, on electrical power from windmills. The absence of a fuel account and the low cost of maintenance enable the windmill to still compete successfully with other prime movers for small powers. On account of the uncertainty in the supply, a storage battery may be necessary for some purposes, as for lighting, which would increase the size of the mill, and hence the interest and depreciation charges for a given service. He gives an estimate of the daily lamp hours available for lighting with a 0.75-kw dynamo and a 12-ft "aermotor." He first gives the power of a windmill for different wind velocities as found by Murphy, who measured the wind-velocity with an anemometer, registering each mile of travel, the power being found by means of a friction break on the driving pulley at the base of the tower. The dynamo being tested, he determines approximately the actual available currents in terms of the wind velocity. The wind velocity available day by day during the period of a year is taken from the sheets of a self-registering anemometer of the weather bureau at Ithaca, N. Y. The anemometer is on the top of a tower, 140 feet from the ground, with the surrounding country for several miles generally lower. From these data he calculates the available lamp hours per day and gives the minimum supplies in periods of calms for an assumed storage battery capacity of 120 lamp-hours. The lowest for the year is 11 lamp-hours per day from May 19 to June 17, or nearly a month when the evenings are shortest. The 17½ lamp-hours for two weeks in October, the 19 lamp-hours for nearly a month from Nov. 19, and 18 lamp-hours for about two weeks in February, fix the real limits of the plant for the year as they occur when the full lighting capacity is required. These minimums can be shortened in time and brought up in value by using a 16-ft aermotor instead of one of 12 ft. The data are given in the article in a series of diagrams.—*Railr. Gaz.*, May 5.

Alternators in Parallel, Driven by Gas Engines.—A short note on the Bentheim-Gildeheus plant, which is the first alternating current central station in Germany, in which alternators, driven by gas engines, are connected in parallel. The synchronizing method of Dettmar is used and appears to be very satisfactory. The gas engines are loaded artificially by means of an adjustable magnetic eddy-current-brake, which is made to act on the fly-wheel, until the phase indicator registers synchronism.—*Elek. Anz.*, June 18.

REFERENCES.

Garbage as Fuel for Lighting Stations.—CAMPBELL.—An abstract of a paper read before a meeting of the English municipal engineers giving a conservative review of the attempts to utilize the heat from garbage and crematories or refuse destructors for producing power. He also describes the plant under construction in Canterbury.—*Eng. News*, July 13.

Arrangement of Steam and Other Pipes in Central Stations.—EDGCOME.—An illustrated paper read before the Municipal Elec. Association, discussing steam-pipes, joints, drainage, steam-traps,

valves, blow-off valves, check valves, pipe covering. Reprinted with the discussion.—Lond. *Elec. Eng.*, June 30.

Condensers for Central Stations.—SNELL.—A paper read before the Municipal Elec. Association. The surface condenser, the evaporative condenser, the ejector condenser and the jet condenser, are discussed. Reprinted with the discussion.—Lond. *Elec. Eng.*, June 30.

TRACTION.

Accumulator Railway.—ZACHARIAS.—A brief description of the line in Ghent on which accumulators are used exclusively. Each car has 12 batteries of 9 cells each, the total weight being about 4400 pounds; the batteries are run from 30 to 36 miles with one charge, and as their total mileage is 68, they must be changed once a day. The accumulators are of the Planté type; an illustration is given; the positive electrode is in the form of a block made of piles of horizontal, corrugated sheets of lead with large holes through them; the negative plates are vertical cylinders placed in these holes through the block. For a weight complete of 25-kg, the capacity was 250 ampere-hours at a five-hour rate of discharge.—*Elek. Zeit.*, July 6.

Electric Locomotives.—A long abstract of the discussion of McMahon's recent paper (see Digest, June 3 and 10). The discussion was of a technical kind and brought out similar information from others who seem to have had some experience; also some criticisms of the original paper; the discussion, however, is chiefly of local interest as the system of controllers used is not of the type which has been found best in this country. Grove, who had constructed one of the best locomotives tested, appreciated the facts in the paper, but criticised the broad theories based on them. Taylor, who had also measured the tractive resistance of a train, obtained quite different results; his lowest figure was 5 or 6 pounds per ton of train, as compared with 10 pounds obtained by the author, and the shape of his speed curve was quite different; one of the greatest sources of error is the great variation of the acceleration forces with the change in speed. In general the paper was favorably received.—Lond. *Elec.*, June 30.

London.—ROBINSON.—An abstract of a paper read before the English Cleveland Institution of Engineers, giving a description of the scheme of electric tramways in London, as projected by the London United Tramway Co. To avoid the necessity of using the rails as a return, a double trolley system is proposed. There will be two tracks necessitating the use of four overhead wires, which will be connected by the three-wire system. The generating plant will consist of three-phase and continuous current generators, the latter predominating, the former being for the extreme ends of the system, where the current will be converted by means of four rotary converters.—Lond. *Elec. Rev.* July 7.

Electric Barge.—A note stating that an English firm has had a new barge built for propulsion by storage batteries, thereby increasing the cargo-carrying capacity to nearly double the former amount, for the same size of vessel, owing to the space saved by the steam machinery; incidentally it avoids the danger resulting from the heat of the boilers on some forms of cargo. The vessel carries 150 tons of cargo; there are 112 cells each having a capacity of 2000 ampere hours at a normal rate of 300 amperes; the battery is located partly in the bow and partly in the stern, leaving the whole of the intermediate space for the cargo. There is a twin screw propeller worked by two motors of 40-hp each.—Lond. *Elec.* and *Elec. Eng.*, July 7.

Electric Railways in Germany.—A short Consular report on the development of electric railways in Germany. There were at the end of 1891 only three cities in Germany having electric street railways; in 1892 there were five, in 1893 eleven, in 1894 nineteen, in 1895 thirty-two, in 1896 forty-four, and in 1897 sixty-one.—*Am. Eng.*, March.

REFERENCES.

England.—An illustrated article on some large power houses in England.—*Railroad Gaz.*, April 21.

Montana.—BLACKFORD.—An abstract from an address delivered before the Montana Society of Engineers on the steep grade electric railroad between Butte and Centerville, Mont.—*Railroad Gaz.*, March 24.

Hull.—A long illustrated description of the tramway line which was recently opened.—Lond. *Elec. Rev.*, July 7.

Dusseldorf-Krefeld.—BRAUN.—A long translation in abstract of the illustrated paper mentioned Digest, July 22.—Lond. *Elec. Eng.*, July 7.

Surface Contact System.—LINKER.—A short illustrated description of the Linker surface contact system.—*L'Elec.*, June 24.

Generation of Power for Traction.—SCOTT.—In this continuation of his serial (see Digest, July 15), he discusses briefly the various conditions under which combined lighting and traction stations may exist.—Lond. *Elec. Rev.*, June 30.

Electric Traction.—CUNNINGHAM.—A reprint of the paper abstracted in the Digest, July 8.—*Eng. News*, July 6.

Corrosion by Return-currents.—JACKSON.—An abstract of an article on the electrolytic corrosion of underground pipes.—*Railroad Gaz.*, June 16.

Traction Switchboards.—An illustrated description of some devices on traction switchboards to protect the machines from short-circuit and to protect the board from lightning.—Lond *Elec. Eng.*, June 30.

Light Railways.—A list of light railways projected in England. The motive power will be electric in most cases.—Lond. *Elec. and Elec. Rev.*, June 30.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Power Load.—An editorial on the question of how existing single-phase alternating current plants are to obtain a power load. Notwithstanding the development of single-phase alternating current motors, most central station engineers despair of obtaining a good day load with only single-phase currents; continuous current distribution is being used to a still greater extent than formerly. Continuous current plants are being added to some stations, as also an additional set of mains for the power load, with a view to extend the lighting system to continuous current work also. The methods of meeting the difficulty in the United States are pointed out, namely, by changing over single-phase to two-phase distribution.—Lond. *Elec.*, July 7.

Private Plant.—KLINGENBERG.—A long illustrated description of the lighting installation at the Landonvillers villa in Germany, having a capacity of 170 incandescents and 3 arcs. The special feature of interest is that a water power 6.8-hp is transmitted from a distance of over a mile, and that only 2.7-hp are available at the residence, to charge a battery of accumulators. It was cheaper to transmit this small power with a large loss than to generate the power by steam.—*Elek. Zeit.*, July 6.

REFERENCES.

Accumulator Installations.—A brief illustrated description of what is said to be a very modern installation in the Dun building, New York city, containing three units of 100-kw each, a booster and a battery.—*Elec. Rev.*, July 12.

Taunton.—An illustrated description of the new 450-kw plant. Alternating currents are used with substations.—Lond. *Elec.*, June 30.

Difficulties in Electrical Installations on Vessels.—WALLING.—An extract from lectures delivered before the U. S. Naval War College on the difficulties arising in the electrical installation of a modern vessel, together with their causes and remedies.—*The Eng.*, April 1.

Transmission and Distribution.—TARSHALL.—A reprint of the paper abstracted in the Digest, July 1.—*Eng. News*, July 6.

Accumulators.—DE CONTADES.—An article illustrated with diagrams on the use of accumulators in electric light plants.—*Cosmos*, May 20.

Switchboard.—A brief illustrated description of the one at the U. S. proving grounds at Indian Head.—*West. Elec.*, July 8.

Municipal Ownership at Detroit.—INSULL.—An abstract from *The Economist* of a lengthy analysis of the municipal lighting plant at Detroit, which he claims shows conclusively the futility of such an installation.—*Elec. Rev.*, July 12.

WIRES, WIRING AND CONDUITS.

REFERENCES.

Wire Works.—An illustrated description of the Prescot plant of the British Insulated Wire Co., engaged especially in cable manufacturing.—Lond. *Elec.*, July 7.

ELECTRO-PHYSICS AND MAGNETISM.

Thermo-electricity.—LIEBENOW.—A new thermodynamic theory of thermo-electricity, based on the assumption that heat transmitted from a higher to a lower temperature by conduction is able to produce thermo-electro forces, and conversely that, whenever an electric current excited by external e. m. f. flows through a metallic circuit, a heat current is produced moving from the lower to the higher temperature. By means of the second law of thermodynamics he calculates analytically the maximum possible value of the thermo e. m. f., produced in a metallic conductor of uniform cross-section, if heat is constantly imparted to one end of the same and taken away from

the other end in such a way that the mean temperature of the conductor and the difference of the temperatures at both ends, are constant. The thermo e. m. f. produced in this case is supposed to depend only on the nature of the metallic conductor and the temperature. His concluding formula for the thermo e. m. f. in volts is as follows:

$$d E = \pm 2.04 \sqrt{\frac{R L}{T}}\, d T,$$

in which R is the specific electric resistance, L the specific thermic conductivity, T the absolute temperature. This equation is in approximate agreement with former measurements. In the same way the Peltier and the Thomson effects can also be calculated; the formulas thus found also agree approximately with former measurements.—*Wied. Ann.*, 68, p. 316.

Electrolysis Induced by Röntgen Tubes.—BORDIER and SALVADOR.—To explain the cause of Röntgen ray burns, they suppose that the same are due to the waves produced by the making and breaking of the induction-coil circuit; as the oscillations induced by the break have the greater intensity, they argue that a practically uni-directional current will be induced in neighboring electrolysis, and therefore causes electrolysis. To test this conclusion, they placed an electrolytic cell consisting of copper sulphate in the neighborhood of the Röntgen tube, with its electrodes near those of the vacuum tube. After a quarter of an hour the electrodes were connected with a galvanometer, and a deflection was obtained indicating a current in the external circuit proceeding from the copper facing the anode of the vacuum tube to the copper facing the cathode, thus confirming their conclusions. As no difference is observed when all the Röntgen rays are hindered from reaching the electrolyte, the effect is not due to them directly.—*Comptes Rendus,* June 19; abstracted in Lond. *Elec.*, July 7.

Residual Penumbra.—MALAGOLI and BONACINI.—The penumbra observed in all radiographs is primarily due to the extent of the radiating surface. When this is reduced or screened off to a small joint, a residual effect becomes apparent. The authors studied this residual penumbra after screening off the radiant surface by a series of diaphragms, and arrived at the conclusion that the residual penumbra is due to the diffusion or diffusive reflection by the air itself.—*Nuovo Cimento,* Map; abstracted in Lond. *Elec.*, July 7.

Ions as Condensation Nuclei.—WILSON.—An abstract of a Royal Society paper on the comparative efficiency as condensation nuclei, of positively and negatively charged ions. He found that water condenses much more readily on negative than on positive ions. The experiments consisted in measurements of the expansion required to cause condensation in the form of drops in air initially saturated and containing ions, alternately nearly all positive and nearly all negative. Some questions on atmospheric electricity are discussed.—Lond. *Elec.*, June 30.

Magnetic Rotation of Oxygen.—SIERTSEMA.—He measured the magnetic rotation of commercial oxygen at pressures varying from 93 to 38 atmospheres and found that the ratio between magnetic rotation and density shows a slight decrease at the lower pressures, which is, however, within the errors of observation. The assumption that the rotation is proportional to the density is difficult to reconcile with the results of others who worked at atmospheric pressure and with pressures up to 100 atmospheres.—*Proc. Akad., Amsterdam,* June 26; abstracted in Lond. *Elec.*, July 7.

E. M. F. of Magnetized Flames.—BLONDLOT.—A description of the following experiment: A fish-tail gas burner is provided with two platinum electrodes which dip into the ends of the flame and are connected with the terminals of a capillary electrometer. When the flame is introduced between the pole-faces of a powerful electromagnet, a steady displacement of the meniscus of the electrometer in one direction is observed. On reversing the magnetizing current, the displacement is reversed also. The magnetized flame is the seat of an e. m. f. directed from one end of the flame to the other, the direction being given by the following rule: A man lying on the right side, along the flame, and looking at the south-seeking pole of the electromagnet, will have the e. m. f. directed from his feet to his head. The following explanation is given. The flame gases constitute a conductor moving at right angles to the magnetic lines of force; hence there is an e. m. f. along the flame. The flame represents a thermal motor and a magneto-electric machine at the same time. A converse reasoning explains the curvature of the electric arc.—*Comptes Rendus,* June; abstracted in Lond. *Elec.*, July 7.

Steel for Magnets.—OSMOND.—A piece of cast steel makes a useful permanent magnet, if its "points of transformation" are brought between 350° C. and above the lowest temperature to which the magnet is to be exposed. This condition can be attained by the addition of small quantities of certain other metals in suitable proportions, such as manganese and nickel. A number of these self-hardening steels were subjected to a series of mechanical and magnetic tests. The nickel steels and a manganese steel containing 4 per cent. of manganese show a minimum of remanent magnetism which coincides with the minimum of hardness. For actual use, the samples should, after forging, be brought to a little above the "transformation point" to obtain the maximum magnetic intensity, then brought to 100° to give stability and the result will be a magnet which is magnetically uniform throughout his mass.—*Comptes Rendus,* June 19; abstracted in Lond. *Elec.*, July 7.

Magnetism and Molecular Rotation.—KELVIN.—A note quoting a telegram to the Royal Society of Edinburgh in which he states that "an electrified body is set into rotation by the generation of a magnetic field around it. The magneto-optical phenomena discovered by Faraday, Kerr and Zeeman are to be thus explained." Editorially it is remarked that only a momentary rotation could have been detected, while in the magneto-optical phenomena, continuous rotation takes place.—Lond. *Elec.*, July 7.

Kelvin.—A brief communication in which he replies to the above criticism. He claims that "if an electrified body is set into rotation by the generation of a magnetic field around it, it will, in virtue of its inertia, remain in rotation until the field is annulled, when the rotation will be stopped." He also adds that his assertion "is not founded on observation, but is founded on the induction of an electric current in the metallic circuit in a plane perpendicular to the lines of force, from which it follows that an electrified ring of non-conducting matter must, by the generation of a magnetic field, be set into rotation, in one direction if positively electrified, in the other direction if negatively electrified." He considers an endless non-conducting tube vitreously electrified, filled with an incompressible non-conducting fluid, electrified with an equal quantity of resinous electricity, and gives some mathematical relations. The ring and fluid will rotate in the opposite direction if neither are acted on by any other force than that of the electromagnetic induction, and the rotations will continue until the field is annulled. No further particulars are given.—Lond. *Elec.*, July 14.

Fitzgerald.—A communication referring to the above telegram. The existence of a mechanical force acting on electrified bodies in a varying magnetic field, is a consequence of Maxwell's theory, especially as explained by Heaviside, who showed that the electric forces due to the changing magnetic displacement, are the same as the magnetic forces due to the change in the electric displacement of an electric current. Fitzgerald endeavored to demonstrate this experimentally, but was deterred by the small amount of force to be expected, and other difficulties. He originally considered that the Zeeman effect was caused by a rotation of electrified atoms, but concluded that while it might be a minute effect, it was too small to explain the large observed effect, but this depends on a number of assumptions. If the Zeeman effect is due to rotation of the atoms, it is not easy to explain, on this assumption, the quantitative difference of the effects on different spectral lines, nor how the varying masses of different atoms seem to have different effects. He made some experiments to see if any gyrostatic effects of magnetization could be observed, but he could not find any.—Lond. *Elec.*, July 14.

S. P. Thompson.—A communication on the Phillips phenomenon which at first sight he believes to be cognate to the above statement of Kelvin. He gives an account of this phenomenon of the whirling ring, as described by Phillips in 1898. The apparatus produces suddenly an intense magnetic field between a pair of pointed soft iron poles inside of a vacuum tube. A luminous ring suddenly appeared within the bulb between the ends of the electrodes and at right angles to the lines of magnetic force; the ring revolves concentrically around the axis of the magnetic field just above the gap, the direction of rotation being reversed with the polarity of the poles.—Lond. *Elec.*, July 14.

The three above communications are also discussed editorially. It is pointed out again that the maintenance of continuous rotation is possible only if the charged body is moved freely against nothing else but inertia; an ordinary charged body in rotation would involve friction and similar retarding forces, which would oppose continuous rotation; in a case of charged atoms, however, as supposed by Kelvin, the absence of such retarding forces modifies the effect and the rotation may continue as long as the field exists.—Lond. *Elec.*, July 14.

REFERENCES.

Oscillatory Discharges of a Condenser.—BARTON and MORTON.—A short paper of highly mathematical character, read before the Physical Society of London, discussing analytically the criterion for the oscillatory discharge of a condenser of given capacity through a wire of given resistance and given inductance. It is followed by a supplementary note.—*Phil. Mag.,* July.

Leakage of Electricity from Charged Bodies.—BEATTIE.—An illustrated paper read before the Royal Society of Edinburgh, giving the results of researches on the leakage of electricity from metallic plates covered with various substances when the plates were placed in an atmosphere whose temperature was gradually raised from the temperature of the room up to 250° C. or 300° C.—*Phil. Mag.,* July.

Velocity of Electric Waves.—GUTTON.—A description of a device for testing the equality of the speeds of electric waves along a wire and through the air. The results of tests showed that the waves traverse either the air or the wire with the same speed.—*Comptes Rendus,* June 19; abstracted in Lond. *Elec.,* July 7.

Monochromatic Light.—FABRY and PERROT.—An abstract of a French Academy paper on the application of the arc between mercury in a vacuum, as an intense source of monochromatic light.—*L'Ind. Elec.,* June 25.

Royal Society Exhibition.—A mention of the electrical exhibits. Among them were Davidson's stereoscopic apparatus for Rontgen ray images; Swan's form of the Caldwell interrupter; Swinton's interrupter (described elsewhere in the Digest); and an apparatus by Petavel for reproducing the Violle standard of light (based on the light emitted by molten platinum) more readily and effectively.—Lond. *Elec. Rev.* and *Elec. Eng.,* June 30.

ELECTRO-CHEMISTRY AND BATTERIES.

Behavior of Chromium.—HITTORF.—A reprint of a short paper read at the recent meeting of the German Electrochemical Society. He gives the results of an investigation of the very curious behavior of this metal, which he referred to more briefly a year ago. He claims that the results prove that this behavior is not due to an invisible coating of the oxide. The metal at ordinary temperatures is not attacked by dilute solutions of the strong acids, but it is attacked quite rapidly when the temperature is increased; it is then in its active condition in which, with platinum, it forms a primary battery of over 1.3 volts; this condition remains even if subsequently cooled. If the metal is made the anode, the development of hydrogen ceases and the metal becomes inactive; if the current is then reversed it takes its active state again. Other experiments are also described, but no attempt is made to explain this curious behavior. In the discussion Ostwald generalized the action; Hittorf did not agree with him; he adds that the formation of chromic acid requires energy to be supplied from an external source; he also states that chromium at ordinary temperatures is truly a noble metal.—*Zeit. fuer Elektrochemie,* July 6.

Solvents.—KAHLENBERG and LINCOLN.—They determined to what extent ferric chloride, antimonious chloride, bismuth chloride and mercuric chloride are capable of yielding conducting solutions when dissolved in various organic and inorganic solvents. By far the larger number of solvents which give electrolytic solutions have a high dielectric constant, while solvents of low dielectric power do not give conducting solutions. Nernst's hypothesis, that there is an intimate connection between these two properties, is therefore confirmed.—*Chemical Society paper;* abstracted in the Lond. *Elec. Eng.,* July 7.

REFERENCES.

Zinc.—KERSHAW.—The first part of a summary of those electrolytic methods of extracting zinc from ores, which have been tried industriously. He first discusses the wet processes, in which the roasted ore is leached, in special vats, with a solution of some acid or salt, which is able to dissolve out the zinc, and the resulting solution of zinc after purification is then electrolyzed in a second series of vats. The Ashcroft, Dieffenbach, Siemens & Halske, Nahnsen and Hoepfner processes are discussed. The last two are the only ones which have not proved to be failures.—Lond. *Elec. Rev.,* July 7.

Electric Smelting.—RICHARDS.—The continuation of an illustrated serial on electric smelting.—*Aluminum World,* April.

Calcium Carbide.—KERSHAW.—A summary of the recent literature on the subject of its production and utilization for generating gas.—Lond. *Elec Rev.,* July 7.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Wehnelt Interrupter.—HUMPHREYS.—A long description of extended researches to study the action and properties of this interrupter. Some of the observations have already been made by others and are therefore omitted here. He used the currents from a battery giving 75 volts. For negative electrodes, lead, copper, amalgamated copper, and coils of wire were used, with equal success; the positive electrode was the end of a platinum wire sealed in a glass tube as usual; this platinum becomes pitted due to an arc discharge. The better the conductivity of an electrolyte, the better are the results; dilute sulphuric acid seems to be best for general use. The glow around the anode when examined with a revolving mirror, was found to be intermittent and its spectrum showed hydrogen and oxygen, proving that the light is due to an electric discharge through these gases or compounds of them. The action was greatly disturbed by a strong magnetic field whose lines were at right angles to the current. A change in the hydrostatic pressure alters the pitch of the anode and the character of the spark; an increase in pressure lowers the frequency and produces larger sparks. The kind and quantity of the gases at the positive pole differs from those due to ordinary electrolysis; the negative pole gives off only hydrogen when running at its best; the volume of gas from the positive pole is nearly equal to that from the negative. With a low voltage the interrupter starts at once, independently of where the circuit is closed, but with higher voltages the electrode must be inserted in the acid first before the circuit is closed. With a small electrode the current rises with the voltage to a maximum and then decreases again; with a surface of 4 or 5 sq. mm.; the maximum current was obtained with 50 volts. There are three stable conditions of the positive electrode which change abruptly from one to the other. The breaking becomes steadier with a lowering of the external resistance. With a small self-induction a break can be obtained only with correspondingly small anodes. A decrease in the self-induction increases the average current, which is contrary to what was observed by Pellat. In a shunt to the break there will be a larger current when the break is in operation than when its circuit is open. A frequency of about 300 per second was found to be the best with an ordinary coil for a large X-ray tube. With electrodes of suitable size the action is most satisfactory for both fluorscopic and radiographic work. He concludes with an explanation of the action of the break.—*Phys. Rev.,* July.

Disturbing Effects of Electric Tramways on Magnetic Needles.—MARINI.—A German translation of a report on researches made in Rome, to find the causes of the disturbances. The measurements were carried out by a Wiedemann galvanometer without coils, thus reducing it to a simple magnetometer. Three causes were found: a direct influence of the current in the overhead line and in the rails, noticeable to a distance of not over 150 m.; an influence of the return currents wandering through the soil to a distance of 2000 m.; an influence of the iron parts of the motor cars, noticeable for not more than 50 m. Some diagrams and tables are given.—*Elek. Anz.,* June 22.

Non-integrating Meters.—FERGUSON.—A communication on the recent paper of Ayrton concerning methods of measuring alternating currents (Digest, July 15). He claims that some apparatus devised by Lord Kelvin completely satisfies all the requirements. Kelvin's ampere balance is claimed to be an accurate means of measuring alternating as well as direct currents; on alternating currents no error is introduced by changes of periodicity. As to the electrostatic voltmeters, Kelvin's multicellular electrostatic voltmeter is claimed to be equally well suited for use on direct or alternating circuits, and to be free from error due to stray magnetic fields or temperature; it withstands without sparking or brush discharge, a voltage equal to at least double the maximum scale reading; there is no error from pivot friction, and the damping can be made absolutely perfect. Finally Kelvin's testing set for the measurement of insulation resistance is claimed to have been found to be sufficiently sensitive for all ordinary purposes and at the same time to withstand the rough usage of everyday work on street main testing.—Lond. *Elec.,* June 30.

Alternating Current Ammeters.—A short, illustrated description of an ammeter and a recording ammeter for alternating currents, designed by Heap. The recorder is similar to Elliott's continuous current pattern. The system of instruments is described as follows: "The instrument is connected to a small transformer, the primary of which is one turn carrying the current to be measured. The instrument itself is on the moving coil principle, and the electromagnet,

which takes the place of the permanent magnet in continuous current instruments, is connected in series with the moving coil to the secondary of the transformer."—Lond. *Elec.*, June 30.

Cadmium Standard Cells.—HENDERSON.—An illustrated account of the results of experiments with a special form of cadmium cell. He considers the "crystall" type of cell, using moist crystals of the sulphate, in place of a saturated solution of it, the most satisfactory, both on account of its portability and because the liquid in the cell is sure to be saturated at all temperatures owing to the excess of the crystals. He sums up the results of his experiments as follows: So far as regards the fulfilment of the conditions necessary for a standard of e. m. f., the cadmium cell is distinctly superior to any modification of the Clark cell. The effects of all ordinary impurities are very small, especially the effect of acid salts, which, although they slightly increase the temperature coefficient of the cell, apparently do not affect it in any other way. The effect of added acid, however, increases the e. m. f. and generally makes the cells untrustworthy. Cadmium cells should not be subjected to large and sudden variations of temperatures, on account of the large value of the time-lay of the e. m. f. behind the temperature change.—*Phil. Mag.*, July.

REFERENCES.

Alternating Current Instruments.—SZAPIRO.—A continuation of the discussion with Renischke on the latter's instrument (see Digest, Feb. 25, March 11 and July 15). He still claims that his arguments against the alleged independence of the wave form, are correct. —*Elek. Zeit.*, July 6.

Portable Potentiometer.—An illustrated description of an apparatus devised by Chauvin and Arnoux with which quick and accurate calibrations may be made of voltmeters, ammeters and resistances. The readings are all based on the Clark cell as a standard.—*L'Ind. Elec.*, June 25.

Measuring Instruments.—AYRTON.—A reprint in full of the paper abstracted in the Digest, July 15.—*Eng. News*, July 6.

Electric Thermometer.—A short editorial on an instrument especially adapted for cold storage warehouses. The various ranges of temperature are made audible in an ordinary telephone receiver. —*Eng. Mechanics*, May.

Measuring the Efficiency of Transformers.—An illustrated description of some methods of measuring the efficiency of transformers.—Lond. *El. Eng.*, June 30.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Automatic Repeater for Wireless Telegraphy.—KINGSTON.—A brief suggestion that repeaters might be used at intervals of 20 or 25 miles apart, which would automatically receive the signals on one side and repeat them. To avoid the interference of the received signals, with those on the sending side, he proposes to protect the sending side from the receiving side by a shield of metal. A sketch is given.—*West. Elec.*, July 8.

REFERENCES.

Telephone Switchboard.—CLAUSEN.—The first part of an illustrated article on a switchboard operator's equipment.—*Elec. Eng'ing*, June.

Operation and Maintenance of Telephone Exchanges.—FISHER.—A reprint with the discussion, of a paper read before the Independent Telephone Convention.—*Elec. Rev.*, July 12, and *West. Elec.*, July 15.

Development of the Independent Telephone Business.—CRITCHFIELD.—A reprint of a paper read before the Telephone Convention. —*Elec. Rev.*, July 5.

Value of Long Distance Toll-Lines.—SHEERIN.—A reprint of a paper, with the discussion, read before the Independent Telephone Association. The former journal reprints a map of Indiana showing the independent lines.—*West. Elec.*, July 8, and *Elec. Rev.*, July 5.

An All-British Pacific Cable.—A reprint of a long discussion between the cable companies and the representatives of the Government, concerning state interference with private enterprise.—Lond. *Elec.*, July 7; discussed editorially in the Lond. *Elec. Rev.*, July 7.

Automatic Block Signals.—A short illustrated article on the system of automatic semaphore block signals, used by the Southern Pacific R. R. on its line in Los Angeles.—*Railroad Gaz.*, March 17.

MISCELLANEOUS.

Treatment of Cancer.—MASSEY.—A short abstract of a paper read before the Medical Association of Columbus, describing a new method. By means of electric diffusion, nascent salts of mercury are introduced into the diseased part. The patient is anæsthetized and lies on a large pad forming the negative pole; a small tubular amalgamated gold electrode is inserted into the growth through a small opening, an excess of mercury being also injected with it, this being the positive electrode. Electrolysis of both the mercury and the diseased tissue occur, forming oxychloride of mercury which then diffuses through the body. Out of 10 cases, he cured 9 in this way.—*El'ty.*, July 12.

Effect of Currents on the Human Body.—KATH.—An abstract of a paper read before the Union of German Elec. Eng. There are two kinds of effects; the first is due to large currents, from two to seven amperes, and at high voltage, 1000 to 2000, the contacts with the body being good, as in the electrical chair used with condemned criminals in New York State; in such a case the nerve centres are definitely destroyed. The second kind of effect is due to currents from ten to a hundred times smaller, and death is then the result of a shock to the lungs; in this case, the victim can be saved if he receives proper attention promptly. Moist hands or feet, especially if the moisture contains acid, are of course especially dangerous.—*Elek. Anz.*, June 18.

Solar Heat.—CARPENTER.—A note referring to a report presented to the American Association in Boston, concerning observations covering a period of ten years, of the amount of solar energy received on our Western plains. They show an intensity of from 7 to 17 calories per square meter, from 8 a. m. on sunny days, which is equivalent to from ½ to 1¼-hp per square yard.—*Jour. Frank Inst.*, June.

REFERENCES.

New Platinum Alloy.—COURMELLES.—A communication on a new brilliant yellow alloy of platinum which was formed on the surface of the platinum contact of a Wehnelt interrupter when it had been previously covered with silicate of potash.—*L'Elec.*, June 24.

Removing Wool from Hides.—A reprint of the article noticed in the Digest, July 22.—*Elec. Rev.*, July 12.

Aluminum.—A summary of a number of articles on its production and utilization.—*Sc. Am. Sup.*, July 1.

Mine Defence of Santiago.—CAPEHART.—An illustrated article describing the mines used in the recent war, and how they were raised. —*Cassier's Mag.*, July.

Electricity in Marine Work.—S. D. GREENE.—A long, well illustrated article on the growing application of electricity in marine work in the United States, in the shipyard as well as aboard ship.—*Cassier's Mag.*, July.

Electrical Congress in Vienna.—A very long account of the programme of this congress which was held in Vienna in June, including all the numerous reports which were to be acted upon by this congress; they are only of local interest, and do not refer to technical matters. The papers which were read are noticed in the Digest under separate headings.—*Zeit. fuer Elek.*, June 14.

A full account of the proceedings of the above mentioned congress is given in the *Zeit fuer Elek.*, June 25, and a briefer account in the *Elek. Zeit.*, June 29, and July 6.

Society Meeting.—A brief report of the recent general meeting of the Union of German Electrical Engineers, in Hanover.—*Elek. Anz.*, June 18, and *Elek. Zeit.*, June 22.

Southwestern Association.—A full report of the first annual convention of the Southwestern Gas, Electric and Street Railway Association at Austin, in May. The following papers were presented: Summer attractions for street railways, by Stewart; Means of encouraging diversified uses of electric current, by Wakefield; A model plant under model management: what both should be like, by Strickland.—*St. R'y Rev.*, June 15.

New Books.

THE STEAM ENGINE INDICATOR AND ITS APPLIANCES. By William Houghtaling. Bridgeport, Conn.: The American Industrial Publishing Company. 307 pages, 157 illustrations. Price, $2.00.

This is a compilation of data obtained during the author's professional career, stated to extend over a third of a century, and describes in a clear and concise manner the principles, construction and practical application of the steam engine indication and its accessory appliances.

Rules, tables and data are given, relating to the economical operation of all classes of steam, gas and ammonia engines, and also

information on the adjustment of valves and valve motions, computing horse power from diagrams and extended instructions for attaching the indicator.

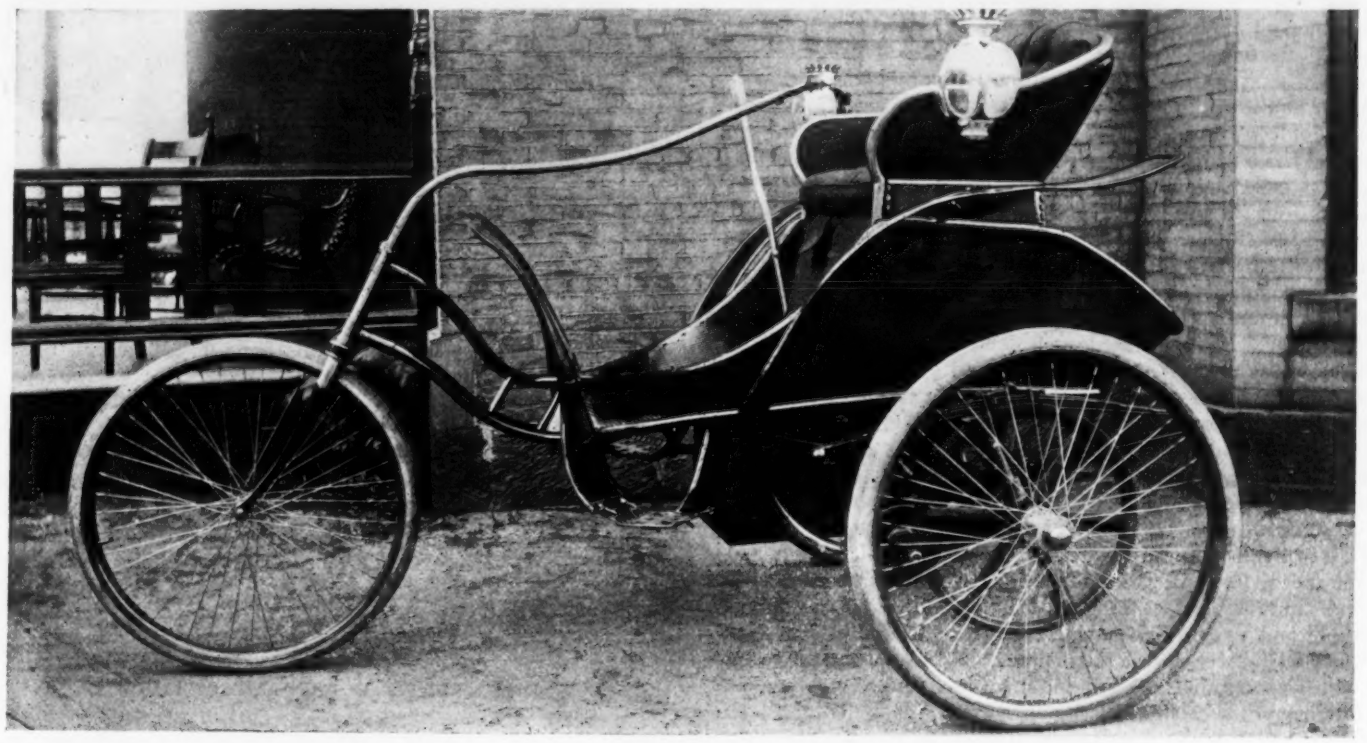
The book is divided into thirty-three chapters as follows: Brief history of the indicator; its purpose; definitions of technical terms; construction of indicator appliances; reducing motions; drum stop and electrical attachment; care and use of indicator; how to take diagrams; the diagram; its study; lines and points of the diagram; isothermal curve; adiabatic curve and points of cut-off; the foot-pound and measurement of diagram; expansion of steam; hyperbolic logarithms; theory of action of steam expansion in cylinders; reading the diagram; different methods of computing the water consumption; indicator testing device; planimeters; comparison of diagrams from throttling and cut-off engines; the economy of expansion; the point of cut-off; back pressure and compression; combining the diagrams of compound engines; diagrams from gas and oil engines and ammonia compressors; making calorimeter tests; miscellaneous diagrams; engine economy; tables.

Several pages in chapter VIII. are devoted to the construction and explanation of an electrical device which may be easily attached to indicators when it is desired to take several diagrams simultaneously.

American Types of Automobiles—IV.

THE EASTMAN VOITURETTE.

EVEN at this early stage of automobile development, a number of fundamental facts have forced themselves upon the notice of the public or have been foreseen by the shrewder manufacturers throughout the country. For instance, it has become obvious that in a large number of cases, the persons desirous of buying or using an automobile do not want a large vehicle such as a brougham or victoria, a coupé or even a hansom. The ordinary runabout has hitherto been the nearest to the light rig they have had in mind, but something lighter and cheaper than that has been a great popular desideratum. The bicycle and tricycle have not only helped to bring about the perfection of the automobile proper, but have suggested the way to gratify the want just mentioned. In France, there has already been a remarkable development of this lighter class of vehicle, to which the generic name of "voiturette" or little carriage has been applied, and as noted in these pages recently, the manager of the late successful automobile exposition in Paris



THE EASTMAN VOITURETTE.

laid emphasis on this type when discussing the results and the outlook. It is along these lines, indeed, that more novelty and development is expected and attempted than any other, and it would be strange if America where the bicycle has been so admirably worked out to its logical technical conclusion did not offer new forms worthy study and patronage. Once convinced that these "voiturettes" can encounter successfully the ordinary difficulties of locomotion on American roads by their endurance, efficiency and economy, there is a large class in the community ready to come forward and buy these vehicles in illimitable quantities.

We are now able to call attention to the latest departure in this line of work. The Eastman Automobile Company, of Cleveland, O., is preparing to market an electric vehicle which for appearance and construction of the body frame is very different from anything yet brought out. Mr. H. F. Eastman is the designer of the carriage. In the vehicle illustrated the body frame is of seamless steel tubing, the upper and lower portions being of single tubes brought from the front around to the middle of the back where a thimble is inserted, and the ends are butted together, pinned and brazed. Following the inner sides of the frame tubes are reinforcing angle bars, brazed to the tubing and forming a ledge upon which are riveted panels of light crimped sheet steel. On the inner surface of the sheet steel are secured strips of asbestos cardboard which serve to muffle noise and insulate the batteries. The whole constitutes a light, rigid and remarkably strong body, a

BOOKS RECEIVED.

CONSTRUCTIONSTAFELN FUR DEN DYNAMOBAN. Von Prof. E. Arnold. Stuttgart: Ferdinand Enke. Two portfolios, 16 x 21 inches. Portfolio I, 64 drawings of direct-current machines. Portfolio II, 48 drawings of single and polyphase alternating-current machines and transformers. Price, each portfolio, 20 marks. (At the request of the publisher, subscriptions for the above work will be received at this office.)

DIE SICHERUNGEN VON SCHWACH- UND STARK-STROMANLAGEN GEGEN DIE GEFARHEN DER ATMOSPHARISCHEN ELEKTRICITAT. (Protection of Low and High-Tension Central Stations against the Dangers of Atmospheric Electricity.) Von Friedrich Neesen. Braunschweig: Frederich Viewig & Sohn. 120 pages, 126 illustrations. Price, 5 marks.

DIAGRAMS AND HANDBOOK FOR TELEGRAPH ENGINEERS. Pocket Edition. By Willis H. Jones. Diagrams by W. A. Van Orden. New York: John B. Taltavall. 115 pages, numerous diagrams. Price, $1.00.

THE INTERNAL WIRING OF BUILDINGS. By H. M. Leaf. Philadelphia: J. B. Lippincott Company. 200 pages, illustrated. Price, $1.50.

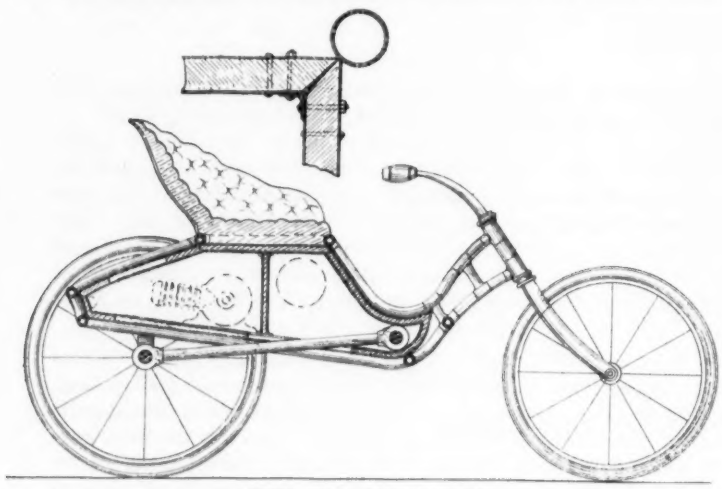
valuable feature of which is that it can be baked in an oven for a bicycle enamel finish, so that both body and finish are practically impervious to weather and wear.

Below this all-steel frame is a solid steel axle provided with ball bearings where the spring supports rest, also a ball bearing in the centre where a hanger drops from a truss eye beam that spans the axle between the spring supports, thus throwing the weight of the vehicle body, battery and passengers in a suspension over the axles. The wheel tread is 4 feet 8 inches, the same as a light horse vehicle. The wheels are fitted with wire spokes drawn tangent and crossed four times, and the tires are 2½-inch pneumatic. On the left hand end of the axle between the hub and the spring bearing are the differential bevel gears, the cone pinions of which revolve on the arms of the large spur gear which is the point of power transmission from the motor, with a reduction of 20 to 1. From the left hand spring bearing and the centre bearing is hung a swinging arm to which the motor is bolted, allowing it to swing in a circle the periphery of which is the same as that of the large spur gear. On the forward end of the motor frame is cast a lug through which a rod falls from the carriage floor. This rod is provided with a pair of spiral springs, one above and the other below the lug, so that when the torque of the current actuates the motor, the motor pinion will climb the teeth of the spur gear and draw taut the springs, either up or down as the case may be, whether a forward or backward motion is given the vehicle.

The motor has a cast steel frame with an aluminum cap over the commutator and brush holders. The commutator is extra long and the brush holders are on rockers. The armature is wound for 20 amperes and has a laminated core. The coils are carefully insulated and clamped into place and are held against centrifugal force by three bands, one in the centre and one at each end around the armature. The fields are wound separately and wedged tightly into chambers in the inner wall of the frame. The motor is plain series wound, very compact and efficient. The weight is 97 pounds; 1¼-hp with a minimum speed of 1200 r. p. m.

The battery which will be used exclusively by the Eastman Company is the well-known Willard, manufactured by Sipe & Sigler, of Cleveland. The battery occupies the space from the rear end of the body directly below the seat. There are four crates of five cells each of 66-ampere hours. Two volts to the cell give 40 volts to the battery which can be charged up to 50, and give, at 15 or 20-ampere discharge, a mileage, under favorable conditions and at a moderate speed of 40 miles to the charge.

The controller is secured to the bottom of the vehicle floor and has three speeds forward, 4, 8 and 16 miles. The first speed throws all the cells in multiple with 10 volts. The second throws two crates in multiple and two in series with 20 volts. The third on high speed puts all in series with full voltage. There is one backward speed which corresponds with the first forward speed and between that motion and the straight up, or off current, is an electric coasting brake which releases just sufficient current to magnetize the fields and offer resistance to the armature. In addition to the electric brake, there is a powerful band brake on the rear axle, operated by pressing a lever with the foot.

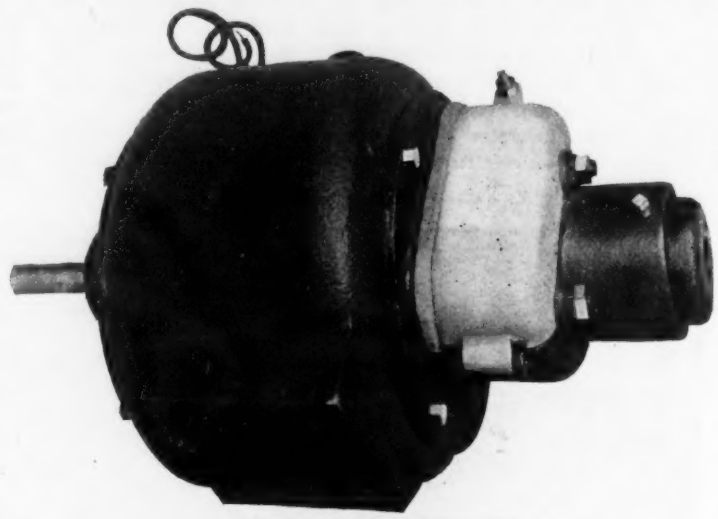


STEEL TUBE FRAME WORK.

The vehicle is provided with an electric gong which is operated by a push button in the end of the controller lever. There are two handsome side lights with ten-volt incandescents which are snapped on or off by a button under the seat.

The forward portion of the vehicle as shown in the illustration, is brought up in a rigid three-way truss, forming a triple steering head with handle bars that sweep upward over the dash and outward within comfortable reach from the seat. The front fork is made with sufficient rake to enable the vehicle to be guided with perfect ease; in fact it can be ridden in a straight line "hands off." For rough roads and over car tracks the steering device is said to prove ideal, demonstrating that for light vehicles and runabouts, the three-wheeler is thoroughly practical.

A four-wheeler with similarly arranged steering device and with heavier batteries and more powerful motor is also being built by the company. It is believed that the greatest demand will be for light vehicles. Accordingly for the present at least, the line will be confined to the two vehicles described. The three wheeler



MOTOR OF EASTMAN VOITURETTE.

weighs about 825 pounds while the four-wheeler will weigh not to exceed 1,000 pounds.

The mechanical construction of this vehicle has been patented in the United States and four European countries; there is also a general overall design patent in this country.

Mr. H. F. Eastman is at the head of the concern and interested in it are M. M. Hobart, A. B. Foster and W. S. Rogers, all of Cleveland. The capital stock of the company is $100,000. It is a good augury that the works of the company are located in the famous old factory of the Brush Electric Company, with which Mr. Rogers was long so prominently identified.

Cutter's High Voltage Street Hood.

The readiness with which the incandescent lamp lends itself to the distributing of light in small units has kept a steady place for it in street lighting, so that even to-day we find the outlying districts as well as the alleys of prominent cities lighted by incandescents. Each of these lamps requires a supporting fixture with a hood to protect the socket from the rain and a smoothly enameled reflector to scatter the light over a wide area. Besides this, there must be insulators for guiding the wires to the hood and means for insulating both these wires and the socket from the supporting bracket, which is liable to be grounded in wet weather. The use of such lamps in series on circuits of, say, 2000 volts makes this matter of insulation all the more important, and in view of this the George Cutter

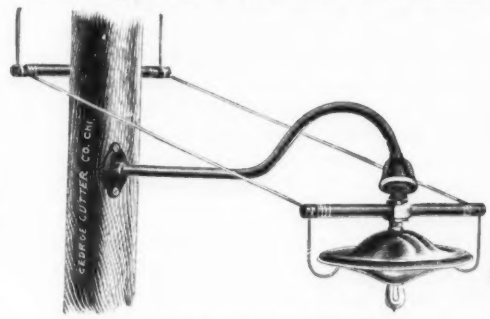


FIG. 1.—HIGH VOLTAGE STREET HOOD.

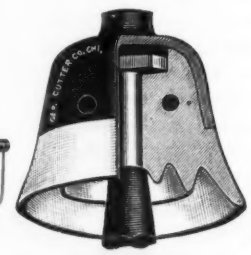


FIG. 2.—SECTION OF INSULATING BELL.

Company of Chicago has now brought out a special form of fixture for use on such circuits.

The new form is shown in Fig. 1, and is unique in having a double petticoat glazed porcelain bell (Fig. 2) interposed between the iron "gooseneck" and the cross-arm over the hood. The cross-arm itself is of wood coated with a baked enamel which keeps it dry. A similar arm fastened to a suitable pole-plate at the back of the pole guides the line wires down at an angle so that they also help to steady the fixture in stormy weather. Then the method of running the wires to the hood gives an effective drip-loop to each so as to keep the rain from following the wire to the socket. The various details have been carefully studied so as to make every part strong, neat and durable.

Coverette.

One of the novelties of the season, recently placed upon the market, is shown in the accompanying illustration. It is a flexible tube 5-16-inch in diameter, and is named "Coverette." It is designed to cover electric light wires and flexible cord, particularly drop-light cord and fixture work. Its use adds materially to the appearance of drop lights, especially in factories, where lamps are suspended from the ceilings over the benches. As will be seen, it looks like a solid permanent fixture, protecting the wires by preventing foreign substances coming in contact with them and causing short circuits.

APPLICATION OF COVERETTE.

This material is supplied in the natural finish, which resembles nickel plate, or it may be procured in rich gold, black, green, white, bronze or aluminum. When desired it is enameled to harmonize with surrounding fixtures and woodwork, as in the case of installations in offices or residences. This specialty is manufactured by the Pacific Electric Company, 120 Main Street, La Crosse, Wis.

The "Criterion" Automatic Acetylene Gas Generator.

Wherever common gas is in use acetylene may be substituted with no trouble beyond the introduction of a generator and the adjustment of new burners.

The engravings illustrate one of the latest styles of acetylene gas generators manufactured by Messrs. J. B. Colt & Co., New York City, for lighting dwellings, outbuildings, hotels, churches,

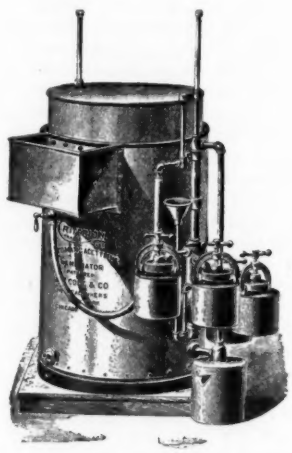


FIG. 1.—"CRITERION" GENERATOR.

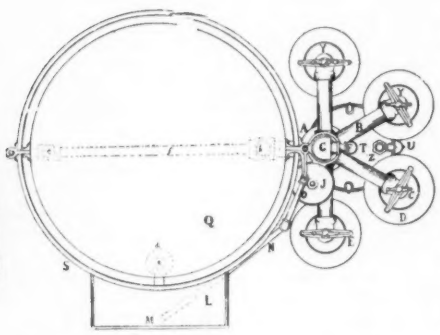


FIG. 2.—CROSS SECTION.

theatres, public buildings and manufacturing plants, large or small, in town or country.

This machine, known to the trade as the "Criterion," Model A, embodies in its construction the same general plan characteristic of all generators of this make, with those special features which have contributed so largely to their popularity for all lighting purposes.

Some changes are noticed, however, in the Model A which have been made to meet the requirements of the several state boards of fire insurance underwriters operating in the East, and which fit it especially for use in that section of the country.

Briefly described, it consists of a gasometer Q for regulating the supply of water, keeping the gas pressure constant and taking care of the surplus gas, and a large upright pipe support A for carrying the four carbide holders D. This support is attached to the gasometer by braces at top and bottom. An automatic trap or wash bottle T, which acts as a condenser for washing, cooling and purifying the gas after it is made and before it goes to the gasometer, where it is stored for service, is located at the bottom and to one side of the gasometer tank S. On one side of the gasometer, near the top, is placed a water tank L, from which the supply of water is taken.

The carbide holders are made in various sizes, and are attached

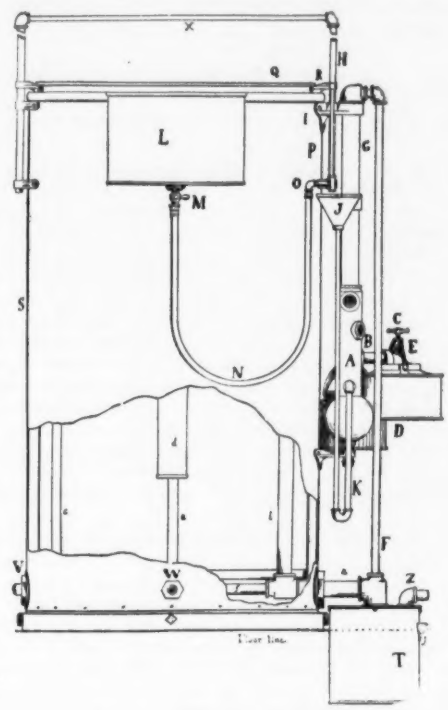


FIG. 3.—VERTICAL SECTION.

to the supporting upright by radial arms B, which extend from it, each holder being on a different level.

The automatic arrangements whereby the production of gas and the regulation of its flow is governed in consonance with the necessities of supply and demand, are positive in their action, and no gas is wasted.

The gas as formed passes through the large upright pipe into the smaller pipe G connected with it, and thence into the automatic trap at the bottom of the tank, where it is washed, cooled and the moisture in it deposited. The gas then passes over the water in the main tank and out into the service pipe ready for use. If an excess of gas is formed the gasometer rises, lifting the spout above the level of the water, thereby stopping the flow, the gas passing into the gasometer, where it is stored until wanted. No gas is formed in the carbide holders not in use, as they are practically cut off from contact with any dampness whatever. The gas is preferably used under a pressure of from two to three inches of water, but when it has to be forced to considerable distances, or through many diverging service pipes the pressure may be increased by placing weights on top of the gasometer.

The machine is extremely simple in construction, and no mechanical skill is required to manage it. The Model A "Criterion" generator requires small floor space, and its cost, including the necessary burners, is as low as compatible with the use of first-class materials and good workmanship. Any capacity can be furnished, from one light to thousands.

Owing to the somewhat different insurance regulations in various parts of the country, Messrs. J. B. Colt & Co. have built another form of generator styled "Model C," which embodies the same general principles of the subdivision of the carbide charge as Model A, but is of quite different mechanical construction. It is stated that the "Criterion" automatic acetylene gas generators have received the written approval of various boards of fire insurance underwriters covering every section of the United States, besides the indorsement of the United States Government.

NEWS OF THE WEEK.

Financial Intelligence.

EDISON ELECTRIC ILLUMINATING COMPANY, of Boston, has declared the regular quarterly dividend of 2 per cent.

WESTERN UNION TELEGRAPH COMPANY is credited with 9182 shareholders and, including its leased lines, with about 13,400. American Bell Telephone is already said to have about half that number.

CONEY ISLAND.—It is reported that the Brooklyn Rapid Transit Company has purchased control of the Coney Island & Brooklyn Railroad Company (De Kalb Avenue line—the only remaining independent line in Brooklyn) at $248 per share.

GLENS FALLS, N. Y., CONSOLIDATION.—Articles of consolidation of the Glens Falls Gas Light Company and the Glens Falls Electric Light & Power Company, Limited, have been filed. The new company is the Glens Falls Gas & Electric Light Company and will start business with a capital stock of $250,000. The principal offices will be in New York City. The directors are Frank S. Butterworth, Walter F. Peacock and Lewis G. Herckenrath, of New York.

WESTERN UNION has been a trifle stronger, above 90, but is curiously unresponsive to all the generally upward tendencies of the times. It ought to have gone to 100 long ago, as a 5 per cent. steady dividend payer, but it is said that this price would have tempted some big holders to sell out, so the advance was checked. There have been reports of a deal with the Postal Telegraph, but nothing has come of it, and President Chandler is now in retirement for some months at his country home in Vermont, exhausted with hard work, and nothing is likely to be done in his absence. Meantime, telegraphic business is said to be good in keeping with the universal state of affairs, although the growing use of the telephone prevents expansion in certain classes of work for the present.

INDIANAPOLIS AND BROAD RIPPLE RAILWAY SOLD.—The Indianapolis & Broad Ripple Rapid Transit Company's railway, its franchises and all its property, free from any liens, was sold on July 15 for an even $200,000. The sale was by public outcry, and John B. Cockrum, the receiver, was the auctioneer. W. F. Brown, an unknown man, was the purchaser. No one interested in the sale of the property knew Brown, and the mystery was shared by all as to whom he represented. While the sale was in progress, a sheriff served notice on the receiver that an appeal had been taken on behalf of the R. T. McDonald estate from the court's order for the sale of the road. The sale was confirmed by Judge Carter on July 17. The receiver presented Mr. Brown's certified check for $56,666.68, which, with his qualification deposit of $10,000, constituted one-third of the purchase money he was required to pay before confirmation of the sale. The deed of transfer, which was later filed in the Recorder's Office, shows the property to have been transferred to "W. F. Brown, of Philadelphia." The McDonald interests appear satisfied and the suits in court will be dismissed. This sale and the unknown Mr. Brown have kept the people busy guessing, and the whole thing is yet a mystery.

THE WEEK IN WALL STREET was somewhat perturbed by the "strikes" on the Brooklyn and New York street railway systems. There are strikes of various kinds, and this one appeared to embody as many evil features as the word will cover. That the men were not in favor of it was shown by the early collapse, and the state of morality of those who took part was evidenced by the resort to dynamite in more than one place. During the week Brooklyn Rapid Transit was dealt in to the extent of 189,466 shares and actually rose to 115⅛, a net gain of 2¼. Metropolitan Street Railway on sales of 27,370 shares closed at 224½, a gain of 2. Western Union was inactive, only 3735 shares being traded in up to 90½, and General Electric was also dull with 2400 shares, closing strong at 120. In Boston, Westinghouse Electric preferred closed the week at 66½; American Bell Telephone, 350; Boston Elevated, 108½; Mass. Electric, 27 bid. In Philadelphia, Electric Storage Battery was dull at 154; Electric Company of America, 17¾; Union Traction, 42¾; Philadelphia Traction, 99½; General Electric Automobile, 6⅛. In Chicago, National Carbon preferred was quoted at 81 and common at 18; North Chicago Railway, 244; South Side Elevated, 100⅛; Metropolitan Elevated, 57. In the New York outside market there was considerable slackness in automobile stocks. Electric Vehicle common was quoted at 91—100; preferred, 110—125; Illinois Elec. Vehicle Trans., 5¼—6; N. Y. Vehicle Trans., 21½—22; N. E. Vehicle Trans, 9⅞—10½; General Carriage Company, 35—38; General Electric Automobile, 10—15. Among other leading stocks Electric Boat common was quoted at 15—17 and preferred, 45; Otis Elevator common, 35—36; preferred, 91—92; Hudson River Telephone, 107; N. Y. & N. J. Telephone, 176—184.

A SMASH IN ELECTRIC BRAKE QUOTATIONS.—No small sensation was caused in Wall Street last week, with detriment to some other electrical stocks, by the smash in quotations of the New York Electric Brake & Coupler Company, whose stock made its appearance on the curb three months ago. It was then noted that the orders in it were executed by or came through one or two newly formed outside brokerage firms. The price of the stock was run up to $73 a share. On Tuesday it was quoted at $68 bid, $69 asked, with a sale reported at $69. One hundred shares were put up for sale Friday by a well known Stock Exchange firm to test the market for it. It was offered down from $70 to $25 without a sale. The would-be seller reported that his house had received the stock from another stock brokerage firm that had been carrying it on a margin of 25 per cent. The stock had been bought in the neighborhood of $65 a share. Then the row began. The New York Electric Brake & Coupler Company has an office at 30 Broad Street, the same office being tenanted by R. F. Grey & Co., an outside brokerage concern. A representative of the company there said: "The New York Electric Brake & Coupler Company has not been concerned in any manipulation of its stock that may have occurred. The company is all right. It was organized under New Jersey laws on April 22 last and has a capital stock of $1,000,000. It owns patents covering electric brakes and has a plant at Winfield, Conn. It has had contracts for brakes pending, though, I believe, none has been closed. Frank T. Morrill has been president of the company and A. F. W. Leslie vice-president. I think, however, there has been a change in the officers. But a small proportion of the capital stock is held by the public. Most of it is still unissued."

Commercial Intelligence.

MANUFACTURING ABROAD.—A leading topic in electrical circles during the past week has been the news that the Westinghouse Electric & Manufacturing Company were about to erect large shops at Manchester, England, where the company recently secured orders from the corporation for four 1800-kw units of engine and generator, supplying lighting current at 110 and 220 volts. It has been reported that these generators will be built at the Pittsburg works, but it seems natural that such large apparatus should be built, if possible, near the point of utilization, to avoid the heavy freight charges. This Westinghouse step following up that of Dick, Kerr & Co., who with Prof. Short are establishing other kindred works in the north of England, naturally makes one wonder why and how long England will endure the invasion. On the whole she will probably prefer to see the goods manufactured on her own soil, and as Mr. Andrew Carnegie says with his usual shrewdness: "The success of the project depends on what the British workmen permits the Westinghouse Company to do." The same authority thinks that the rivalry between the Pittsburg and Manchester shops will be vastly more important than the Shamrock and Defender contest. In the meantime, American electrical manufacturers who have been shipping heavily abroad expect to continue, subject to this limitation only, and all of them report excellent inquiries at current quotations. That we undersell the Englishman on his native heath need not be wondered at when it is positively stated that there is not to-day in all Great Britain a thoroughly equipped motor factory turning out standard sizes from a half to ten horse power and able to deliver twenty of such sizes in response to an order by mail. The Britisher would have to get his material together and ask for three to six months for delivery. In other words, up to the present moment, English manufacture of dynamos and motors has been retail and special; with us it is wholesale and standard and that tells the whole story. A new point of departure has now been reached which may see the cutting down of American electrical exports, but the intrinsic victory of American methods will remain the same. The best platform the American electrical manufacturer can get on is to work for the adoption of the Institute standards for generators, motors, etc. Then any man, anywhere in the world, can order from America and know that he will get what he orders, at best prices.

STATE OF TRADE.—Electrical manufacturers report in general an encouraging state of activity and inquiry, but complain strongly of the difficulty in getting raw materials and manufactured parts, especially the latter. While copper has inclined to weakness with 18½ cents as a high water mark, steel and iron tend to stiffer prices, with rubber and other supplies in attendance. It is said that lack of copper has even restricted the output of one or two concerns, pending delivery. But no line of electrical industry can be reported as dull, and conditions confirm the general Bradstreet report as follows: "The general trade situation has apparently lost nothing in strength. The aggregate of midsummer business is of an unprecedented volume, and signs of expansion in the demand for fall and winter goods increase. Prices, except for the cereals, coffee, raw sugar, and some dairy products, are either firmly held or tend upward. Notable among those advancing are pork products, petroleum, copper, tin, tin plates, and raw wool, while the list of products unchanged includes refined sugar, hides, leather, lead and cotton. Industrial activity continues at the maximum, skilled labor being busily employed, but some troubles are noted among unskilled workers, notably street car employees and 'longshoremen, partly owing to the mischievous agitation and midsummer influences, but also, no doubt, to restiveness at failure of prosperous conditions to materialize in their cases. Crop prospects are encouraging; the movement of grain to market is of immense volume, and railroad earnings consequently continue to show large increases over preceding years. Bank clearings last week were lighter, aggregating $1,681,620,431, a decrease of 13 per cent. from last week, but an increase of 46 per cent. over this week a year ago, of 53 per cent. over 1897, of 70 per cent. over 1896, of 118 per cent. over 1894, and of 60 per cent. over 1892. Business failures for the week number 174, as compared with 174 last week, 188 in the corresponding week of last year, 220 in 1897, 280 in 1896, and 239 in 1895."

NATIONAL EXPORT EXPOSITION at Philadelphia commanded a good deal of attention last week on the part of commercial New Yorkers, and the technical press on account of the special trip organized by the New York Board of Trade and Transportation. The 56 acres included in the grounds have been ceded outright by the municipality to the Commercial Museum, under whose auspices the exposition will open on September 14, and which after the show will occupy permanently three of the buildings. These, near the University of Pennsylvania, are being constructed of brick and steel, and are of a very substantial character. The main permanent structures are rectangular in shape, and lie side by side along the bank of the Schuylkill River. Each is 378x88 feet in size. Between these buildings and connecting them are to be erected temporary structures 297 feet in width. One of these is to be 200 feet in length and the other nearly a hundred feet longer. The effect of the arrangement will be that of one large building. In no part is the structure more than two stories

in height, and the interior is admirable for show purposes. There is a power-house adjoining the most southerly of the main buildings, and any additional power needed will be furnished by the municipality through the public electric wires to motors driving the machinery direct. The exposition, it is estimated, will entail a total expense of a million dollars. Of this, $627,000 will be expended on the buildings. Congress has granted an appropriation of $300,000 to this end, the city has given two-thirds as much; the state of Pennsylvania has set aside $75,000, and the rest of the cost of buildings, together with the expenses of grading, fencing, and beautifying the grounds is to be borne by the Commercial Museum, the Franklin Institute, and by private subscription. There will be an industrial and commercial congress of twenty days, beginning October 10.

EXPORTS OF ELECTRICAL MATERIAL.—The following exports of electrical material are from the port of New York for the week ending July 22: Antwerp—17 cases electrical material $1047; 3 cases electrical machinery $54. Berlin—28 packages electrical material $871. Brazil—16 cases electrical material $160. British East Indies—5 cases electrical material $95. British Australia—9 cases electrical material $3024. Bremen—2 packages electrical material $265. British West Indies—81 cases electrical material $1874. Chili—4 cases electrical material $189. Central America—63 packages electrical material $1542. Cuba—40 packages electrical material $4967; 27 packages electrical machinery $370. Dutch West Indies—1 case electrical material $22. Dublin—47 electric cable reels $14,803. Ecuador—4 packages electrical material $96. Glasgow—2 cases electrical material $18; 2 cases electrical machinery $210. Havre—111 cases electrical material $5091; 14 cases electrical machinery $813. Hamburg—22 packages electrical machinery $884; 60 packages electrical material $7878. Japan—121 packages electrical material $7239. London—7 cases electrical machinery $765. Liverpool—2 cases electrical material $331. Mexico—15 cases electrical material $1596. Madrid—80 cases electrical material $1621. Manchester—5 cases electrical material $8560. Peru—2 cases electrical material $50. Santo Domingo—3 cases electrical material $43. St. Petersburg—3 cases electrical material $135. U. S. of Colombia—292 packages electrical material $2449. Vienna—1 package electrical material $50. Venezuela—10 packages electrical material $438. The total of electrical apparatus for the month of May was $241,103 and for the eleven months ending May 31 was $2,517,797, or nearly $700,000 more than in the same period of 1898.

PRICE OF COPPER.—Holders of copper last week were asking 18⅝c. for lake. The mining companies refuse to duplicate sales of a few days ago and some of the producers will not take any further orders. Europe has been taking more copper recently and it is thought when consumers there are ready to come in the market for big quantities they may be disappointed in finding the supply so light. Sales have been made up to the end of the year, and it is surprising to see domestic consumers show such confidence in the market by buying up to December at stiff figures. There are indications that copper will have a large market for a long time to come, and this will greatly stimulate new sources of supply. D. Houston & Co., in their monthly copper circular, say: "Holders of copper are well sold up for several months ahead, and the market is very strong, indicative of the underlying soundness of the position. Consumers have been very busy, and some of the large mills have lately been running extra night shifts in the casting and wiring departments. Instead of suspending operations around this period of the year, for the customary space of about 10 days, certain of the large consumers can spare a shutdown of only three days, in order to clean up and make necessary repairs to machinery. New schemes for electric equipments for railroads are projected and the demand for copper for electrical purposes will require enormous quantities of this metal in the future."

FIRE ALARMS FOR THE QUEEN.—The National Electrical Manufacturing Company, Milford, Conn., have received through their English agents an order for 46 of their improved fire alarm boxes and necessary relays, repeaters, etc., to be installed at Windsor Castle. The apparatus will be distributed through the palace and when an alarm of fire may be given from any of the boxes it will be transmitted to the central receiving apparatus, consisting of the relays, etc., and then automatically repeated by means of a repeater to fire headquarters. Electro-mechanical gongs will be connected in series with the above apparatus and will give an audible warning throughout the grand old pile with its countless treasures. Mr. J. G. Noyes, the secretary and general manager says: "The entire system when completed will be very similar to those now used in the largest cities in the United States. As the fire alarm apparatus now in use in London is very antiquated, our agents are strongly convinced that the installation of this plant in the Queen's Palace will be the entering wedge not only for the equipment of the other palaces but for plants in the large cities of England with this same style of apparatus." The order appears to have been awarded after brisk competition.

LARGE CONTRACTS FOR A SMELTING PLANT.—During the past week large contracts were given out for the plant of the St. Louis Smelting & Refining Company, one of the plants of the National Lead Company. The electrical contract has been given to the General Electric Company, who will furnish all the generators and motors, including two 250-kw generators, a switchboard, and electric locomotive, and electric hoists. The Lidgerwood Manufacturing Company will supply the hoists equipped with the General Electric motors. There will be in addition motors for the pumps, crushing machinery, machine shop, etc. To the Electric Storage Battery Company has been awarded a large contract for batteries to be operated as an economic auxiliary. The engine contract was awarded to Filer & Stowell, of Milwaukee, including one cross compound 850-hp engine, one cross compound 375-hp engine, and cross compounds for the air compressors. Babcock & Wilcox Company take the boiler contract. Mr. A. A. Cary, 95 Liberty Street, has been retained as consulting engineer, and for the electrical equipment he has called in his electrical associates, Messrs. Floy & Carpenter.

BULLOCK ELECTRIC MANUFACTURING COMPANY report an active inquiry for the season and have a large number of likely bids out. They have just closed up an interesting contract with the Butterick Publishing Company for about thirty motors, to be used in printing the millions of dress patterns that are so famous with womankind. There will be eight 5-hp motors, seven 7½-hp, eight 2-hp, and about six 1-hp, all slow speed direct connected. The order for the generators is still outstanding. They have also sold to the Blodgett Estate, Boston, a 150-kw generator, 250 volts, at 125 revolutions, to be used for power and light, and principally to drive six electric elevators. Mr. Lozier says he thinks this is the first 250 volter to go into Boston. He has also taken a contract from Nicoll the tailor, Brooklyn, for a 60-kw engine type direct connected generator, and hears from Cincinnati headquarters of the sale of an 800-kw 80 revolution generator for the West.

RIKER ELECTRIC AUTOMOBILE COMPANY has taken another long step forward in the acquisition of the well-known Lewis & Fowler car shops at Elizabethport, N. J. The property comprises no fewer than 49 city lots and has a capacity for turning out five street cars daily. This will represent about ten Riker automobiles per day, or, roughly, 2500 a year of all sizes. Mr. Riker is giving the transfer to the new works his personal attention, in spite of a big run of new business and has been overhauling the engines and boilers, wiring up, and buying new tools to supplement the equipment from the Brooklyn factory. Mr. Riker remains prominent and is chief engineer, but there have been rumors that Mr. Daniel Lewis would have accepted the active presidency of this progressive concern if other duties had permitted. The Sever and Fliess figures of comparative cost of horse and automobile operation were made with a Riker delivery wagon in New York City.

MR. HENRY HINE, the new general manager of the Sprague Electric Company, spent a part of last week in company with Mr. W. D. McQuesten, going over the big factory at Watsessing and sizing up the situation and possibilities. He shares the feeling of the trade that the opportunities for this concern are still very much underdeveloped in many directions, and that with its control of the Sprague multiple unit system for railways, the conduit work, the Lundell generators, and motors, the popular fans, and other lines, it should cut a much bigger figure and be far better known than it is to-day. It may not be generally known that all the elevator work is done through the Sprague Elevator Company, which is a part of the Otis combination, but outside of this Mr. Hine's ability and long experience as an electrical manufacturer will have liberal arena for their display.

STRUCTURAL STEEL has been advancing again in price, while as an old street railway man remarked last week, it was a lucky thing that the industry had been able to develop while steel rails and copper were so much cheaper than to-day; otherwise the rate of progress would have been much slower. It is noteworthy, however, that even at present prices for structural steel that material is entering more and more largely into central station and power house construction, the style of work lending itself eminently to the use of that metal. This week the Berlin Iron Bridge Company reports securing a contract from the Syracuse (N. Y.), Electric Light & Power Company for an extension of their power house. It will be 70 feet wide and 100 feet long, one story, with brick side walls and steel framework, the latter carrying two traveling cranes over the dynamos and engines.

THE SOUTH has witnessed recently a remarkable development of its water powers by electricity, and the end is not yet by any means. Mr. M. B. Barr, the New York representative of the Stanley Electric & Manufacturing Company, which has several admirable plants in the Southern states, is very much pleased over an order it has just received from the Montgomery (Ala.), Water Power Company, to be installed at Tallassee on the Tallapoosa River, by the International Hydraulic Company as engineers, and the Chapman Construction Company as contractors. About 3000-hp will be delivered to the local company for distribution, half for lighting and half for cotton mills, railway works, etc., in and around Montgomery. There will be three 875-kw generators, three-phase, 2000 volts stepping up to 30,000 for a line transmission of thirty miles and then stepping down to 2000 again for use. Morgan Smith turbines will be employed in this interesting installation.

AUTOMOBILE BUILDING is a topic of frequent discussion in the electrical trade, and some of the supply houses are seriously considering the advisability of securing agencies or of adding a department of this nature to their business. "If we don't," said a well-known dealer last week, "some of the old bicycle stores looking for fresh pastures, will be doing a larger electrical retail trade than we are. Some of us may also take up handling gasoline and other carriages, which will be easy to concerns employing so many good mechanics as many of us now do. If we can't get the automobiles, we shall have to get them built ourselves, buying the parts and thus undercutting the concerns that stand out for the present high prices. Putting in isolated plants is far harder work than assembling a few tubes of steel and hitching on a battery and motor."

INDEPENDENT TELEPHONE MANUFACTURE.—Rumors last week were pretty persistent that the combination of several independent telephone manufacturers was going through instanter, but those interested in this city say it is about where it was two months ago and is moving forward slowly. It seems that Mr. W. P. Williams, U. S. assistant treasurer, who has been engineering the matter with Mr. Blaine and others, was in town last week, and was reported in consultation with Mr. Charles R. Flint, who has been so active in various industrial enterprises of this character. The proposed capital of $7,000,000, half preferred and half common, is not large as finances go nowadays, but the plan being to buy out with cash where needed, the nervous money market has not been altogether favorable even for that moderate figure.

USE OF ALUMINUM.—Light on the growing use of aluminum is shown both by the prosperity of the makers and by the increase in the number of plants producing it electrically. The Shawinigan Water & Power Company, which is developing a large power on the St. Maurice River, Quebec, is said to have made a contract with the Pittsburg Reduction Company for the disposal of a large quantity of the power produced, in the manufacture of aluminum. The Pittsburg Reduction Company has also given notice that on August 1, 1899, it will pay the principal and maturing interest on all of the outstanding six per cent. gold bonds of the company, being Nos. 51 to 200 inclusive for $1000 each, being an issue of bonds bearing date of February 1, 1896. Both items reflect the activity and prosperity of the concern.

CABLE WORKS BURNED.—A London despatch states that the Western Electric Company's plant at Woolwich, England, was totally destroyed by fire on July 21. The loss is estimated at $1,250,000. Western Electric people in

town report that they know practically no details beyond the above. The factory is understood to be the Fowler-Waring plant, acquired some few years ago by the Western Electric Company, which was one of the first progressive American manufacturers to invade Europe. It has several such establishments, and Mr. F. R. Welles, its representative, has become intimately acquainted with a large part of Europe in pushing its enormous business in cables, telephone apparatus, etc.

ORDERS FOR McEWEN ENGINES.—Hamilton & McClave, 141 Broadway, have been awarded an order for three 16 by 16 inch McEwen engines, built by the Ridgway Dynamo & Engine Company, to be installed in a large building being erected at 580-590 Broadway by Weil & Meyer, and direct connected to Western Electric 100-kw machines. They have also received an order from the Standard Electric Light, Heat & Power Company, of Avoca, Pa., for a 14 by 14 belted McEwen engine.

OAKMAN MOTOR VEHICLE COMPANY has been incorporated, in which Philadelphia, Lancaster, Pa., and Vineland, N. J., capitalists are interested. The object of the company is to manufacture and sell automobiles. The company's charter allows it to construct and operate electrical carriages of every description, as well as vehicles propelled by gas, steam or gasoline. It is empowered to acquire territorial rights. The paid-in capital stock is $5,000,000.

BALDWIN-WESTINGHOUSE LOCOMOTIVES.—An order has been placed through New York by the Government Railways of Japan, for seven electric locomotives to be used, it is said, in mining operations, probably coal work. These machines are the joint product of the Westinghouse Electric & Manufacturing Company and of the Baldwin Locomotive Works.

FALCON ELECTRICAL MANUFACTURING COMPANY, of New York City, has been formed with a capital stock of $50,000, the directors being L. E. Rorup, of Brooklyn, and E. Leissner and H. O. Swoboda, of this city. The latter is well known as an electrican and inventor, and was until lately engaged with one of the large electrical manufacturing concerns here.

UNITED STATES MOTOR COMPANY.—Pittsburg and Allegheny capitalists, with $1,000,000 capital stock at the beginning of business, have received a Delaware charter for manufacturing and selling automobiles in the name of the United States Motor Company. The company will make electrical and other vehicles.

Special Correspondence.

NEW YORK NOTE.

LONG TRIP FOR ONE-ARMED MESSENGER.—Albert V. Roe, a one-armed messenger boy of the Postal Telegraph Company, started at 9 a. m., Sunday, July 23, from the office at 253 Broadway to ride on his bicycle to San Francisco. Roe is 19 years old. He intends to ride about 65 miles a day. He will deliver messages to the company's agents at Albany, Buffalo, Cleveland, Chicago, Council Bluffs, Omaha, Denver, Salt Lake City and San Francisco. He will pay his own expenses, although his salary will continue as usual.

PHILADELPHIA NOTE.

SCOTT ELECTRIC COMPANY, of America, is the name of a new corporation which has bought out the old Scott & Janney Electric Company, of Philadelphia. The same people are in it before as owners and leaders, namely Mr. Gordon J. Scott, the inventor, and Dr. W. S. Janney, but they have some important new inventions and larger plans for future work and development.

PITTSBURG NOTE.

MR. E. T. DREIER, an electrician of Honolulu, Sandwich Islands, arrived in this city a few days ago to take a course at practical work in the shops of the Westinghouse Electric & Manufacturing Company at East Pittsburg. Mr. Dreier's father is the owner of extensive sugar plantations in Hawaii, which are equipped with electrical machinery, furnished by the local company.

OHIO NOTES.

THE STROWGER AUTOMATIC TELEPHONE COMPANY and the Columbus Edson Electric Company, of Columbus, have reduced rates to consumers 10 per cent. It is stated that a fierce rate war will result.

THE LORAIN COUNTY RAILWAY COMPANY, through its president, Mr. Parks Foster, has amended its charter so as to permit it to have termini in the city of Elyria and at a point between Elyria and Amherst.

THE CLEVELAND CITIZENS' STREET RAILWAY COMPANY has applied to the village of Glenville for a franchise to build a line through Doan Street. If granted it will give Cleveland a new cross town line.

THE NORTHERN OHIO TRACTION COMPANY, which is a consolidation of the Akron, Bedford & Cleveland and the Akron Traction and Electric Railway companies, has decided to build a new line to Barberton. The road between Akron and Cleveland is to be double-tracked.

THE TELEPHONE IN PORTSMOUTH.—A company of Portsmouth people, with a capital stock of $50,000, proposes to put in a new telephone system with a capacity of 600 instruments at a rental of $1.50 per month. A majority of the citizens, it is stated, are against it, claiming that the existing company renders adequate service.

A SUCCESSFUL STRIKE OF MESSENGERS.—The night force of the American District Telegraph messengers in Cleveland, Ohio, 80 in number, went out on a strike on July 18, causing embarrassment to the Western Union Telegraph Company in the delivery of telegrams. The strike was ended the next day by the company agreeing to raise the boys' wages sufficiently to pay them for the use of their bicycles, which seems to have been the grievance leading to the strike.

THE CLEVELAND TELEPHONE COMPANY has made such rapid progress of late that it has been found necessary to install several new exchanges. The company has 11,000 subscribers and it is claimed the city has better telephone service than any city of its size in the country. Plans are being laid for five new exchanges. They are to be of brick and stone, of artistic design and fireproof. As far as possible the windows will be made dustproof in order to protect the mechanism of the switchboards. The improvements including buildings, land and switchboards will probably cost $150,000.

STRIKE OF RAILWAY EMPLOYEES IN CLEVELAND.—The 800 union employees of the Cleveland Electric Railway Company went on another strike July 17. They claim that the agreements made by the company in the settlement of the first strike have not been lived up to. Much violence and riotous demonstration took place during the past week. The disorder was so great that the state troops were called out. On Sunday evening last a car on the Euclid Avenue line was blown up by dynamite placed upon the track, resulting in the fatal injury of four passengers and serious injury of five others. At last accounts violence still continued.

MR. H. A. EVERETT and other Cleveland capitalists are at the head of an enterprise to build a trans-state railway from Cleveland to Wheeling, W. Va. No attempt will be made to attain great speed and it is not the intention to compete with the railroads for long distance trips. The line will touch many small towns and is believed the transient travel will make it remunerative. A new road from Canal Dover to Massillon will be one of the first connecting links in the line. From Massillon a road will be built to Akron to connect with the existing line to Cleveland. A survey is now being made for a road from Uhrichsville to Cadiz, which will connect with the existing line from Canal Dover to the former city. From Cadiz to Wheeling there is a railway in operation, which will probably be purchased.

CHICAGO NOTES.

MR. J. G. POMEROY, who has recently taken charge of the western sales department for the Adams-Bagnall Electric Company, of Cleveland, reports business good especially in alternating enclosed lamps, which are now being used exclusively by some of the leading plants of the country.

THE CHICAGO & MILWAUKEE ELECTRIC RAILWAY.—An agreement has been made between the Chicago, Milwaukee & St. Paul and the Chicago & Milwaukee Electric Railway, by which the electric road is to use the steam railway's tracks from Evanston to Chicago, a distance of about five miles. The electric line is about completed, and will soon be running from Waukegan to Evanston, a distance of 30 miles. The new connection will make it possible to run trains from Waukegan to Chicago, 40 miles. It will also establish a line from Milwaukee, Wis., 85 miles north of Chicago, to Chicago. When the line is opened it will be possible to ride from Milwaukee, Wis., to Hammond, Ind., the latter being 38 miles south of Chicago, on electric cars, with but five changes in traveling 123 miles. The fare will be less than a cent a mile. The Chicago & Milwaukee Electric has issued $1,500,000 20-year 5 per cent. mortgage bonds to the Cleveland Trust Company, of Cleveland, Ohio. Of this issue $1,000,000 is to cover the 30 miles of road now constructed, and the $500,000 remaining is to be used for extensions and improvements.

THE INDEPENDENT TELEPHONE COMPANY.—Mr. Albert G. Wheeler, of the Illinois Telephone & Telegraph Company, is preparing the prospectus of his company and making plans for financing it. The plans of the new company are closely guarded, but it is believed that the owners of the telephone franchise intend to start with a capitalization of $5,000,000 4½ per cent. 10 to 20-year gold bonds and $5,000,000 of capital stock. At the outset it is understood only half the issues will be offered for subscription. With the money thus to be realized it is proposed to construct three main conduit trunks radiating north, south and west from the business centre of the city. At the limits fixed by the ordinance the wires will be brought up and continued on poles. The company hopes to progress far enough to have 4500 instruments in service before the beginning of next year. The service will be gratuitous under the term of the contract by which the Illinois Company acquired the right to use the Strowger automatic system, until such time as the subscribers number 10,000. Then a straight rate of $72 a year will be announced.

INDIANA NOTES.

RIGHT OF WAY has been secured for an electric railway from Angolia to Goshen, a distance of 23 miles.

STREET RAILWAY EXTENSION.—The Board of Public Works at Indianapolis has asked the Indianapolis Street Railway Company to extend its line to Riverside Park. There is some contention about running the line through the park, instead of skirting the edge of it.

PRIVATE RIGHTS OF WAY.—Charles L. Henry, general manager of the Union Traction Company, July 14 filed with the Recorder of Marion County, at Indianapolis, forty-two grants of private rights of way along the Pendleton road to the Indianapolis, Anderson & Marion Electric Railway. This practically completes the right of way the entire distance.

CONTRACT LET.—The preliminary contract for the construction of the proposed Logansport & Indianapolis Electric Railway has been closed with C. H. Lawrence, of Detroit, Mich., representing the International Construction Company. Under the terms of the contract that company agrees to build the road and handle $750,000 of the bonds of the railway company. The estimated cost of the road is $1,500,000.

FORT WAYNE ELECTRIC RAILWAY ORDERED SOLD.—The sale of the Fort Wayne Consolidated Electric Railway Company by the receivers previously appointed, has been ordered to take place within six weeks. The Guarantee Trust Company of New York holds mortgages for $725,000, and the Guardian Trust Company of Cleveland has mortgages aggregating $2,085,321. Other miscellaneous liens against the company aggregate about $200,000.

THE FARMERS CONSENT TO RIGHT OF WAY.—The managers and surveyors of the Martinsville, Waverly & Indianapolis Electric Railway announce that the right of way has been secured from farmers all the way along the line. It is given out that the company will build a power station dam at Waverly, and that it will be the point where the company will first break ground. The dam, it is reported, will be built during the next two months, and the completion of the grade and bridges this fall. Wires and rails will be placed early next spring.

UNION TRACTION COMPANY'S PLANS.—General Manager Henry, of the Union Traction Company, has given out that the company had abandoned the plan of building power houses at Alexandria and Daleville for electric lines to Muncie, Marion, Alexandria and Elwood, and instead one of the largest power houses in the west will be erected in Anderson, at an estimated cost of $275,000. Expert construction men from Philadelphia will prepare the plans and superintend the construction. All orders for power houses elsewhere have been canceled. Anderson will furnish the power for all the lines controlled by the Union Traction Company, the system being patterened after the Niagara Falls line to Buffalo. The three-phase system will be employed, rotary converters being used to reduce the voltage. The grading on the line to Muncie is well along and work on the Indianapolis line will begin next week.

WISCONSIN NOTES.

AUTOMOBILE MOTORS.—The Milwaukee Electric Company has received an order for 100 motors for automobiles for a Chicago firm.

OTTO J. WALLBER has removed to 37 Oneida Street, Milwaukee, where he will continue carrying on an electrical supply and contracting business.

MUNICIPAL PLANT IN MILWAUKEE.—It is probable that at the next meeting of the Common Council of Milwaukee an ordinance will be introduced to issue $100,000 in bonds to begin the erection of a municipal electric lighting plant.

INCREASE OF WAGES.—The La Crosse Street Railway Company, of La Crosse, has granted the request of the conductors and motormen for an increase of pay from $40 to $42 a month and 15 cents for each extra trip, which will bring their average monthly earnings up to about $45.

THE CONDUCTORS AND MOTORMEN of the Chippewa Valley Electric Railroad Company, July 7, presented a request for a raise of wages of about 25 per cent. and for certain privileges. As yet no reply has been given. A tie-up of the Eau Claire, the Interurban and the Chippewa Falls lines will probably result if the answer is not favorable.

FRANCHISE GRANTED IN STEVENS POINT.—The council of Stevens Point passed the franchise of the Jackson Milling Company, of Grand Rapids, Wis. By this franchise the company is allowed to use the streets of Stevens Point for purposes of furnishing electric lights and gas to the city and inhabitants as well as to transmit power to industries that are located or may locate there.

A STREET CAR COMPANY has been organized by the heirs of the late David McCartney, to operate the McCartney street car lines at Green Bay. The new company will be called the McCartney Electric Street Railway & Power Company. The officers of the new company are: President, T. J. McCartney, Chicago; vice-president, Frank Schoenfield, Green Bay; secretary and treasurer, J. H. Taylor, of Green Bay. These officers, with Mrs. L. Whelen, of Green Bay, and William McCartney, of Barnesville, O., constitute the Board of Directors. The capital stock is $33,000.

CONSOLIDATION IN OSHKOSH.—A movement is on foot to consolidate the Citizens' Traction Company of Oshkosh and the Fox River Valley Company of Appleton. The former runs the Oshkosh electric street railroad, and the interurban between Oshkosh and Neenah. The latter owns a road between Neenah and Appleton. It is reported that they will combine and build as far as Kaukauna. A meeting of the representatives of the companies was held at Neenah July 11. It was attended by Charles Pfester and John I. Beggs, Milwaukee; Mr. Holcomb and H. D. Smith, Appleton, and J. Trester, of Cincinnati.

THE NEW CITY AND INTERURBAN LINE of the Waupaca Electric Light & Railway Company, of Waupaca, has been opened for business under the most favorable conditions. The line is five miles long, and runs from the Wisconsin Central Railroad station to the Wisconsin Veterans' Home, and the Chain o' Lakes. Heretofore the only manner of reaching these places has been by omnibus and private conveyance. The generator of the new company is operated by water power, a never-failing and abundant supply of which is at hand. The Waupaca Electric Light & Railway Company is owned by I. P. Lord and W. B. Baker, president and secretary and treasurer, both of Waupaca.

THE CHICAGO & LAKE SUPERIOR TELEPHONE COMPANY.—If reports which are given out with every appearance of authenticity are true, the proposed Chicago & Lake Superior Telephone Company, which was to put in an exchange in Oconto, is likely to be sold to the Wisconsin Telephone Company within a few days. Negotiations are said to be pending between the two companies for the transfer of the good will and property of the new company, and are likely to be completed soon. The Chicago company, which has had representatives investigating the chance of exchanges and a toll line system along the Wisconsin division of the Northwestern line, is headed chiefly by St. Louis capitalists and is represented in Wisconsin by Carl G. Wells, formerly an employee of the legislature. The proposition was to establish a cheap system.

MINNESOTA NOTES.

MR. O. CLAUSSEN is now looking out for the interests of the Fort Wayne Electric Works in Minnesota, Montana and the Dakotas. He makes his headquarters at 203 Newspaper Row, St. Paul, Minn.

ELECTRICAL REGULATIONS.—During the last session of the Minnesota Legislature a law was passed, entitled: An act to regulate persons and corporations engaged in installing or repairing electrical wires and apparatus in certain cities of the state of Minnesota and to provide for licensing persons and corporations to carry on such business. On July 10, Governor Lind appointed the following as members of the examining board: W. T. Gray, electrical engineer and contractor, Minneapolis; Oscar Clausen, electrical engineer and agent for the Fort Wayne Electrical Works, St. Paul; W. F. Carpenter, proprietor of the Twin City Electrical Works, Minneapolis; Chas. L. Pillsbury, City Electrical Inspector of Minneapolis and Joseph Macauley, foreman North Western Telephone Exchange Co., St. Paul. Their terms of office are respectively for five years, four years, three years, two years and one year. The regular term of office being five years, this gives the board a new member every year. Three kinds of licenses, known as Master, Journeyman and Special, are to be issued under the following conditions: Prior to six months after the passage of the law, licenses are issued to those actually engaged in electrical work upon registration with the board and the payment of a fee of $2, except in the case of Masters, who are required to furnish an approved $5000 bond. All those who fail to register within the above time and all new comers will be required to present themselves before the board for examination. Master's licenses will be issued upon the proof of three years' experience in electrical work, the payment of a $5 fee and the filing of the above-mentioned bond. Three years' experience are also required of journeymen and a fee of $3. Special licenses only may be issued to applicants under 21 years of age. The cost of registration is $2, and two years' experience is necessary. All licenses thus issued are perpetual, but may be revoked by the board for cause after a full hearing. By master electrician is meant one engaged in installing or repairing electrical wires and apparatus. Journeymen electricians can do electrical work only while in the employ of master electricians who are required to file a $5000 bond with the examining board to insure against damage or injury due to incompetence or the use of improper materials. A clause in section 9 provides for apprentices under the condition that not more than one apprentice to two electricians shall be employed by any master electrician. The new law is limited in application to counties having a population of more than 125,000 and does not affect interstate telegraph and telephone companies in any way.

ST. LOUIS NOTES.

NEW ELECTRIC RAILWAY.—The Millstadt (Ill.) aldermen are agitating the project of a direct electric railway to East St. Louis and the citizens offer to grant right of way without cost to the company that will build the road. They will also donate the land for a power house.

REORGANIZATION OF STREET RAILWAY INTERESTS.—A meeting for the general reorganization of the street railways purchased by Brown Bros., of New York, has been called for Thursday, Sept. 20. The official notification in the call is that the stockholders of all the St. Louis lines will meet and consent to the issuance of the companies' bonds to the extent of $45,000,000. It is likely that the property owned by the United Railways Company under different names will soon be transferred to the company.

FRANCHISE AT PUBLIC AUCTION.—The presiding judge of the St. Louis County Court has proposed to his associates on the bench that the franchise for the belt lines around St. Louis, which is so eagerly sought, be disposed of at public auction and thus bring the maximum price into the coffers of the county. There are three applicants for the franchise—First, James C. Jones, H. C. Wagoner and Ackman Welch; second, Mayor A. L. Fleming of Webster Groves, C. P. Walbridge and John C. Wilkenson; third, J. D. Houseman, manager of the Wellston Creve Coeur Lake & St. Charles Railroad.

THE ST. LOUIS & BELLEVILLE TRACTION COMPANY, of Belleville, Ill., has been incorporated, with a capital stock of $1,500,000. The incorporators are J. A. Day, Edward Abend and C. B. Barret, of Belleville, and Z. W. Tinker and George J. Kobusch, of St. Louis. It is said that the new company will be used as a means to bring about a consolidation of the St. Louis & Belleville Electric Railway Company, known as the Day line, running between East St. Louis and Belleville, and the St. Louis, Belleville & Suburban Railroad. There has been a general belief for some time that the two East St. Louis—Belleville lines would be consolidated.

CHANGE OF NAME.—The Central Traction Company, of this city, filed with the Secretary of State last week an affidavit changing the name of the corporation to United Railways Company of St. Louis. The United Railways Company stockholders met on July 20 and elected the following board of directors: Edwards Whittaker, Charles D. McLure, Henry C. Haarstick, William H. Thompson, W. E. Boyle, C. H. Spencer, Patrick Calhoun, Murray Carleton, H. S. Priest, F. E. Marshall and G. W. Hunter. The first six named are the new directors. Edwards Whittaker was elected president; Jilson Coleman, of Brooklyn, N. Y., general manager; James Edkins, secretary and treasurer; Thomas W. Murphy, claim agent.

TEXAS AND MEXICO NOTES.

AN ELECTRIC FREIGHT RAILWAY, two miles in length, is being constructed at Saspamco, Texas. It will be used principally by the large sewer pipe manufactury located there.

MR. THOMAS HERLET, an American electrical engineer, has applied to the Mexican government for a concession to construct an electric street railway system in the City of Guanajuato, Mexico.

STREET RAILWAY PURCHASED.—The street railway line at Seguin, Texas, has been purchased by Mr. Rudolph Wilman. It is reported that it will be extended and immediately equipped with electric power.

THE EMPRESA STREET CAR COMPANY, of Monterey, Mexico, recently completed the building of important extensions of its system and the new lines were inaugurated with much pomp, passengers being carried free on the opening day.

WAR TELEGRAPHERS.—An order was recently issued by the War Department of Mexico for all telegraph operators attached to the army, especially those attached to the cavalry troops, to report to the central Federal telegraph office for practice in the heliographic service.

DAMAGE TO TELEPHONE LINES.—The recent flood in the Rio Grande did considerable damage to the telephone system connecting and jointly operated in the cities of Larede, Texas, and Nuevo Laredo, Mexico. The poles and wires extending across the river were washed away and communication was interrupted for some time, but the repairs will soon be completed.

NEW CHIEF OF MEXICAN TELEGRAPHS.—It is reported that Augustin M. Chavez, general manager of the Federal telegraph system of Mexico has resigned his position on account of ill-health and that Francisco A. Soni has been appointed to succeed him. Mr. Chavez has the reputation of being one of the ablest public officials of Mexico. He has done a great deal to promote the trade relations between Mexico and the United States and the great reforms in the telegraph service of that country are due to his energetic and well directed efforts.

MR. W. F. DOUTHITT, of New York City, general counsel of the Eastern syndicate which recently purchased and consolidated under one management the San Antonio Street Railway, the Edison Street Railway, the San Antonio Gas Company and the Mutual Electric Company, all of San Antonio, is now in the latter city looking over the newly acquired properties with a view of recommending extensive improvements to the syndicate. The street railway lines are to be extended and several miles of new track will be laid. The suit against the syndicate for alleged violation of the Texas anti-trust law in purchasing and consolidating the four separate interests is now pending in the court of civil appeals. The case was won by the State in the lower court. A decision will be handed down by the higher court next October.

PACIFIC COAST NOTES.

COMPETITIVE ELECTRIC LIGHTING.—Santa Rosa, Cal., now enjoys competition in the electric lighting and power business. The Merchants' Lighting Company is nearly ready to supply current in opposition to the Santa Rosa Gas & Electric Light Works.

THE NAPA GAS & ELECTRIC COMPANY was recently incorporated with the following directors: Thomas Addison, Berkeley; John L. Howard, Oakland; O. E. Clark, Napa, Cal.; S. E. Kearney, San Francisco and J. G. Whittington, Alameda. The capital stock is $100,000; subscribed, $75,000.

THE BRITISH TRANS-PACIFIC CABLE survey steamer Egeria, Captain Smyth, recently left San Francisco for Honolulu, the trip to occupy one month, during which soundings will be made. The survey sloop Penguin completed a survey some two months ago from Australia to Honolulu. The Egeria is now completing the work. The cable, on which work will be commenced shortly, will be laid from Vancouver, B. C., to Honolulu, thence to Fanning Island. From that point there will be three branches—one to Norfolk Island, one to Australia and the third to New Zealand. The total length of the cable and branches will be 8200 miles, and the cost about $8,500,000.

CANADIAN NOTES.

SHELBURNE, ONT.—The council is considering the question of installing a municipal lighting plant.

LORETTO, QUE.—The Loretto Electric Light Company has been formed to light the village by electricity; capital, $10,000.

ARNPRIOR, ONT.—The council has appointed a committee to learn on what terms the electric light company will dispose of its plant to the corporation.

BEAR RIVER, N. S.—The people are trying to secure the construction of an electric railway five miles in length to connect this town with the main line of the D. A. R. railway.

KAMLOOPS, B. C.—The council will employ an expert to report on the advisability of purchasing an entirely new plant for electric lighting purposes, the one in present use being of insufficient capacity.

LONDON, ONT.—A deputation from this city recently waited upon the Government at Ottawa and asked for a subsidy to aid the construction of an electric railway from this city to Goderich, a distance of 66 miles.

NIAGARA FALLS, ONT.—A by-law to raise by debentures $71,000 for purchase of the Niagara Falls Electric Light Company's plant by the town was carried. It is proposed to deliver day power to the Ontario Silver Plate Company, which has decided to remove its works to this town.

THE CATARACT POWER COMPANY, of Hamilton, Ont., has taken over the Hamilton & Dundas railway line, and will tear up that portion of the line within the city limits. The cars will run over the Hamilton street railway inside the city, the Cataract syndicate having purchased the street railway also.

THE EASTERN TOWNSHIPS ELECTRIC COMPANY has been incorporated by the provincial government of Quebec, with a capital of $300,000, for general electric purposes. Among the incorporators are the following Americans: Walter H. Coleman, electrical engineer; Jacob W. Barnard and John H. Champion, all of Andover, Mass., and William D. Currier, of Lawrence, Mass.

FENDERS IN MONTREAL.—The Montreal Electric Street Railway has adopted and will equip its cars with the fender invented and patented by Mr. G. W. Sleman, of Guelph, Ont., which the management considers the best fender brought to their notice. Orders for the equipment of all the company's cars have been given and within a month it is expected the work will be completed.

MONTREAL, QUE.—The Montreal Belt Line Railway is applying to parliament for power to issue securities to the amount of $4,000,000 for the construction of the Montreal section of the company's proposed railway system; also to issue bonds to the extent of $300,000 for each bridge which it has authority to construct, across the Ottawa and Prairie rivers, also debentures for $1,000,000 for docks, elevators, buildings, etc. The company also ask power to construct various extensions.

THE CHAMBLY PLANT.—The new plant built by the Royal Electric Company for the Chambly Manufacturing Company, of Montreal, has been turned over to the latter concern, and water power is now being used instead of steam to run the new system which is now supplying power to that city. Steam may be used occasionally. The several trials of the new plant have proved most satisfactory. This plant was fully described and illustrated in *The Electrical World* of October 9, 1897, and in ELECTRICAL WORLD AND ENGINEER, June 3, 1899.

A UNIQUE PLANT.—A 75-kw S. K. C. dynamo was put in operation at Grand Valley, Ont., a short time ago, and is now supplying from one phase of the machine the town of Grand Valley with 500 incandescent house lights and some 50-cp street lamps. From the other phase of the same machine, which is wound for 5000-volt current, the town of Arthur, 12 miles away, is supplied with about 600 incandescent house lights and five enclosed arc lamps, as well as fifteen 32-cp incandescent street lamps. This plant is one of the most unique and complete in Canada.

CARBIDE WORKS AT OTTAWA.—The construction work on the power house and factory for the Bronson & Weston Carbide Works, at the Chaudiere Fall, Ottawa, Ont., is being rapidly pushed forward to completion. The factory is being built entirely of stone and steel and will be five stories high. The contracts have been let for the electrical machinery and water wheels, which, together with the carbide plant, will cost over $225,000. The electric plant is being supplied by the Canadian General Electric Company. The generating plant will consist of two 3000-hp single-phase generators, directly connected to horizontal turbines without gearing. There will also be two 400-hp 225-volt direct current machines for operating motors for crushing, mixing, etc. The current will be conveyed from the large alternators at a potential of 2300 volts to the transformer house and carbide works, where it will be stepped down to 75 volts for the furnaces. The 225-volt current will also be taken direct from the generators to the various buildings for the supply of power. The entire plant, it is expected, will be in operation by January 1, next, and the works will be run day and night.

LACHINE POWER IN MONTREAL.—The proprietors of the Standard Light & Power Company, Montreal, have decided to erect a fireproof station in that city. The building will contain a steam plant of 2000-hp, and will be equipped with the latest type of engines and rotary converters. Work of construction has already commenced and the boilers are being manufactured in Scotland and are to be delivered and placed ready for steam by October 20 next. The Standard plant is worked in connection with the Lachine Rapids Hydraulic Company, which is supplying the motive power for driving the machinery. The steam plant is to be put in as an auxiliary to guarantee an uninterrupted service to patrons of the Standard Light & Power Company, and can be used, should occasion require, to generate a three-phase current and assist the Lachine Rapids in the event of abnormal conditions occurring. In addition to the above, a steam plant is also being erected at the suburban town of St. Henri. The building is also fireproof, and is already completed. The engines, which are of the Westinghouse type, are being installed, and the Manning upright boilers are completed and will be installed at once. The object of this plant, which is also worked in connection with the Lachine Rapids Company, is to protect the street lighting of the towns of Westmount, St. Henri, Ste. Cunegonde and St. Louis de Mile End, all of which towns have contracts with the Citizens' Light & Power Company for the town lighting. When the above are completed, the Lachine Rapids Company will have a standby steam plant of over 4000-hp. This company has already contracted with the General Electric Company to increase the Lachine Company's electric plant at the Rapids by 5000 electric horse power, which will give a capacity to the plant at the Rapids for immediate use of 10,000 horse power. These latter machines are to be delivered in October next.

General News.

THE TELEGRAPH AND TELEPHONE.

DUCKTOWN, TENN.—The Ducktown Telephone Company has been incorporated.

FONDA, IOWA.—The Northern Telephone Company has been organized in this place.

PITTSBURG, PA.—The Home Telephone & Electric Company has been chartered, with a capital stock of $150,000.

DENVER, COL.—The Colorado Postal Telegraph Company has been organized to build telegraph lines. The capital is $100,000.

LEXINGTON, KY.—The Fayette Telephone Company, which was recently incorporated, has received a franchise for the construction of its system.

BUCHANAN, VA.—The Botetourt Telephone Company has been incorporated, with a capital stock of $5000, to maintain and operate a telephone exchange.

PANA, ILL.—The Pana Telephone Company has sold its plant and franchises to a Chicago syndicate represented by W. S. Gregg, of the Chicago Standard Boiler Works.

FARMINGTON, ILL.—The Farmington Telephone Company has been organized, with a capital stock of $500. The incorporators are J. W. Connelly, F. S. Vandersloot and A. H. Fash.

CHICAGO, ILL.—The United States Telephone Manufacturing Company, with a capital stock of $25,000, has been incorporated in this city by Ira D. Perry, John B. Weir and J. B. Halpenny.

SALEM, MASS.—The New England Telephone & Telegraph Company has purchased some property in this city and will proceed at once to erect a brick building exclusively for telephone purposes.

NEW ROCHELLE, N. Y.—The new telephone exchange in this place has been put into operation. The business district was connected up first and the residences will be added as soon as practicable.

WATERTOWN, N. Y.—The Citizens' Telephone Company of this place has been organized, with a capital stock of $50,000. The directors are Robert Bliss, New York, and C. N. Sherman, of Watertown.

NEW YORK.—It is said that the New York, New Haven & Hartford Railway Company is having a system of telephones installed along the line so as to be prepared in case its telegraphers should strike.

ELIZABETH, N. J.—The New York & New Jersey Telephone Company has asked for permission to place its wires underground in this city. The application is opposed by the Elizabeth Telephone Company.

HAVANA, CUBA.—It is stated that the Western Union Telegraph Company intends to lay another submarine cable to Havana from Miami, Fla., by way of Key West. The work will be commenced in the fall.

EASTON, MD.—The Union Telephone Company will be purchased by Thos. L. Davy, of Ridgely, Md., and associates. They will reorganize the company, enlarge the plant and rebuild the line with copper wire.

CINCINNATI, OHIO.—The Ohio Postal Telegraph Cable Company has been organized here, with a capital stock of $100,000. The incorporators are F. W. Conger, L. W. Rose, A. M. Beatty, all of Cincinnati.

LITTLE VALLEY, N. Y.—The Village Board has granted a franchise to the Union Telephone & Telegraph Company for 25 years. The maximum rates for service will $15 a year for business instruments and $9 for residences.

TRAVERSE CITY, MICH.—The Independent Telephone Exchange in this city was sold on July 18 by the sheriff to satisfy a $13,000 mortgage. The holder of the mortgage bought in the property at $10,000. The original cost is said to have been $20,000.

MT. VERNON, IOWA.—The Mt. Vernon Telephone Company has been organized, with a capital stock of $10,000. The officers are James E. Harlan, president; E. B. Willix, vice-president; T. A. Gormly, secretary; Dr. J. B. Albrook, treasurer.

PITTSBURG, PA.—The local telephone company at Homestead and Braddock has swung a 50-wire cable between the two towns to take the place of the temporary connection which has been in use. A cable to connect Braddock and McKeesport has also been swung.

ST. MARY'S, PA.—The Elk Telephone & Telegraph Company has been organized in St. Mary's to do a local telephone business. The capital stock of the company is $20,000, and the incorporators are G. W. Boyer, C. G. Wilson, A. L. Blaisdell, B. E. Wellendorf, A. Kaul, all of St. Mary's.

MINNEAPOLIS, MINN.—The Mississippi Valley Telephone Company is nearly ready to give service in the Twin Cities. All the cable has been laid in the conduits and spliced, and nothing now remains but to set up the switchboard in the exchange and connect the instruments. About 1100 wall instruments have been placed about the city.

SWANTON, VT.—The People's Telephone Company, of this place, an independent concern, has informed its subscribers that it is about to withdraw from the business. Unforeseen expenses, loss of subscribers, together with other conditions which have arisen are the reasons given for the sale of the property to the New England Telephone Company.

GUTHRIE, O. T.—A charter has been issued to the Central Telephone Company. Its capital stock is $10,000, and the incorporators are B. F. Marsh, of Dover, president; Mr. Weltz, of Kiel; vice-president; A. M. Mead, of Kingfisher, secretary; W. L. Taylor, of Dover, treasurer; Frank Cronkhite and John Wahling, of Kiel. The principal place of business will be at Kingfisher.

ABERDEEN, S. D.—The Dakota Central Telephone Company has bought the lines of the Western Telephone Company west of here to Bangor, Bowdle, Eureka and other points, embracing 125 miles, and also a line from Clark to Watertown, 100 miles in length. This gives the Dakota Central Company over 1600 miles of wire. The company is now building a 75-mile line from Sisseton to White Rock, S. D., and to Wheaton and Fairmont, Minn.

FRANKLIN, N. H.—Mr. G. H. Davis has completed his telephone line from Tilton to New Hampton. It is his intention to immediately extend the line from New Hampton to Bristol and eventually to Alexandria, Bridgewater and Danbury. With these towns connected with the Citizens' Telephone Company's lines, and the towns which the Kearsarge Telephone Company, of Salisbury, is to take in, the Citizens' Company will cover this vicinity quite thoroughly.

NEW YORK.—The American Telephone & Telegraph Company is rapidly completing the additional copper circuits necessary to handle the probable large increase of business when the new long distance charges will be put in force. The new tariff, now expected to be ready by Jan. 1 next, will make the charge from Boston to New York three-fifths of the five-minute rate, namely, $1.20; and from New York to Chicago $5.40, the five-minute charge being $2 and $9. The new rate makes corresponding reductions all over the Long Distance Company's system. It was intended to introduce the three-minute rate on July 1, but it was found impossible to complete the necessary arrangements by that time.

ELECTRIC LIGHT AND POWER.

THOMASVILLE, GA.—W. S. Keefer has applied for a franchise for an electric light plant.

BLISSFIELD, MICH.—An electric light plant is to be established here, at a cost of $10,000.

MONTICELLO, FLA.—Mr. Max Golphin will establish an electric light plant at this place.

BEEVILLE, TEXAS.—An electric light plant is to be erected in this place by Mr. C. N. Dunlap.

KINGSTON, N. C.—The power house of the Kingston Electric Light Company was recently damaged by fire.

FREMONT, OHIO.—The Fremont Gas & Electric Company has been organized, with a capital stock of $150,000.

DEFIANCE, OHIO.—The organization of the People's Gas & Electric Company, with a capital stock of $50,000, has recently been reported.

WASHINGTON, D. C.—Mr. W. A. Jones, of the Department of the Interior, is asking for bids until Aug. 7 for an electric light plant for the Warm Springs Indian Agency.

JEFFERSONVILLE, IND.—The Jeffersonville Light & Power Company has been incorporated, with a capital stock of $9500, by J. C. Knight, H. C. Knight and L. A. Ibins.

PLAQUEMINE, LA.—The city will issue $38,000 of bonds to establish an electric light plant and acquire the water works. The mayor can give further information on the subject.

SHELBY, N. C.—It is reported that an electric light plant will be established on the Broad River, about 12 miles from this place. Mr. H. D. Wilson is interested in the enterprise.

POINT PLEASANT, W. VA.—The Point Pleasant Water & Light Company, which was recently incorporated, has been granted a franchise to construct water works and an electric light plant.

LAKEWOOD, N. J.—The Lakewood Water, Light & Power Company has been organized, with a capital stock of $150,000. The incorporators are Frederick H. Green, William H. Blair, Carroll F. H. Bassett.

SAN FRANCISCO, CAL.—The Truckee River General Electric Company has been organized, with a capital stock of $2,500,000. It proposes to supply electric light and power to San Francisco and other places.

BELGRADE, MINN.—The contract for the construction of an electric light and water plant for this village has been awarded to Fairbanks, Morse & Co., St. Paul, Minn., for $7500. The work will be completed Nov. 15.

HARRISBURG, PA.—The Harrisburg Light, Heat & Power Company has been incorporated, with a capital stock of $2000, by E. Z. Wallower, W. O. Bishop, H. Cohen, T. H. Heist and E. B. Mitchell, all of Harrisburg.

HARPER'S FERRY, W. VA.—Mr. John A. Livers, of Gettysburg, Pa., and associates propose to erect a water power plant at Harper's Ferry for the generation of electricity for light and power for distribution in neighboring towns.

SAN FRANCISCO, CAL.—A request for an appropriation of $80,000 for a modern lighting and heating plant at the new general hospital has been approved by General Shafter. It is thought that it will be allowed by the War Department.

KITTANNING, PA.—The Armstrong Electric Company has been organized here to supply heat, light and power. Its capital stock is $1000. The company was incorporated by A. B. Norton, W. F. Taylor, E. B. Greene, W. H. Markland, all of Altoona; S. Lutz, Kittanning.

BAKER CITY, ORE.—The Eastern Oregon Power Company, with a capital stock of $100,000, has been incorporated. It will erect and operate electric power plants for mining, milling and other purposes and will operate electric railways. The principal office is in Baker City. Among the incorporators are F. Baillie, A. Geyser and J. T. English.

SAN BERNARDINO, CAL.—Mr. Lloyd, the owner of the electric light plant here, desires to build an electric railway in San Bernardino, provided he be granted a free franchise and be exempt from taxes until the property clears 5 per cent. on the investment. Mr. Lloyd also wants to be relieved from his contract for lighting the city.

RIO VISTA, CAL.—The Clear Lake Power Company, the promoters of which propose to furnish electric lights in Calistoga, St. Helena, Napa and other towns in that vicinity, has issued its prospectus. The entire cost of installing the plant ready for operation is placed at $656,095, which includes $108,800 for a reserve steam plant for use in emergencies. The capacity of the plant will be 4000-hp.

CHESTER, PA.—The Beacon Electric Light Company of this place has been absorbed by the National Electrical Company, which has headquarters in Philadelphia. The Beacon Company has the city lighting contract and is the only electric light company here. It is stated that the National Company proposes to absorb all the small plants in the vicinity of Philadelphia, with Chester as a central point.

PANA, ILL.—The Pana Modern Electric Light & Street Railway Company has sold its plant and franchises to a Chicago syndicate represented by W. S. Gregg, of the Chicago Standard Boiler Works. The Pana Telephone Company was also purchased. The consideration was $100,000. The syndicate will make extensive improvements. It is stated that the same parties expect to place a contract for the Taylorville Electric Light Company's plant.

ANOKA, MINN.—The City Council has repealed all ordinances relating to the water and light contracts and passed resolutions refusing to accept the service from the Anoka Water Works, Electric Light and Power Company. This action is based on the claim that the rates are exorbitant, and the Council hopes to break the contract on the ground that thirty years is an unrea-

sonable length of time, relying on a recent decision of the Supreme Court of Minnesota, in a somewhat similar case, wherein it was stated that thirty years is an unreasonable length of time for Western cities of uncertain future. The Court, however, retracted later by saying that in some cases where large and permanent investments must be made, as in water works, thirty years may not be an unreasonable length of time. The franchise for the above plant was obtained ten years ago by Mr. E. T. Sykes and a contract made with the city. The city agrees to rent for a period of thirty-one years 25 1200-cp arc lamps at $2112 per year, additional arcs to cost $7 per month, and all arcs to burn every night except when the moon shines clearly. This is, of course, not a moonlight schedule. Incandescent lights are furnished at one cent per lamp hour.

THE ELECTRIC RAILWAY.

CHESTER, PA.—A power house for the Chester & Darby electric railway is to be built at Rutledge, Pa.

SHREVEPORT, LA.—The Shreveport Electric Railway Company has decided to make a number of improvements on its line.

MANSFIELD, OHIO.—It is announced that $400,000 in bonds were issued on July 1 for the construction of an electric railway from Mansfield to Shelby.

SAVANNAH, GA.—The Savannah, Thunderbolt & Isle of Hope Railway Company is considering the extension of its electric line to Warsaw Island, in the suburbs.

LEAVENWORTH, KAN.—It is stated that the promoters of the Kansas City & Leavenworth Electric Railway are making plans for a large power house, to be erected in this city.

DETROIT, MICH.—The Detroit Municipal Railway has been organized, with a capital stock of $25,000. The incorporators are H. S. Pingree, E. G. Stevenson, J. C. Hutchins, all of Detroit.

AKRON, OHIO.—The Cleveland, Wadsworth & Southern Electric Railway Company has applied to the Commissioners of Summit County for a franchise to connect Akron with Loyal Hope and Wadsworth.

HOUGHTON, MICH.—Messrs. Stone & Webster, electrical engineers of Boston, have definitely decided to build the electric belt line in the copper district and will start construction early next month.

SHAMOKIN, PA.—The Shamokin Street Railway Company has been leased to Monroe H. Kulp & Co., with the option of purchase. Improvements will be made on the road and part of the line will be practically rebuilt.

NEW YORK, N. Y.—The stockholders of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Company at a recent meeting decided to increase the capital stock of the company from $2,500,000 to $7,500,000.

DUBUQUE, IOWA.—Messrs. Linehan and Molo, local capitalists, owners of the Star electric plant, have closed a deal for the purchase of the property of the Dubuque street railway. The consideration is said to have been $200,000.

NIAGARA FALLS, N. Y.—The new suspension bridge across the Niagara River, connecting Lewiston Mountain with Queenstown Heights, was opened to traffic last week by the International Traction Company, the syndicate controlling the bridge companies.

ST. PAUL, MINN.—The Ramsay-street barn of the Twin City Electric Company was totally destroyed by fire on the night of July 19. Sixty cars were burned with the building, as well as a quantity of supplies stored on the second floor. The loss is estimated at $125,000.

NEW YORK, N. Y.—The stockholders of the Prospect Park & Coney Island Railroad in Brooklyn Borough have ratified the agreement to lease the road to the Brooklyn Heights Railroad Company. The lease is for 999 years on terms which have not been made public.

SYCAMORE, ILL.—An electric railway line will be built between DeKalb and Sycamore, Ill. Belvidere street car owners are arranging to build the line, which will run along the side of the wagon road, and will, in all probability, be in working order by October.

GRAND RAPIDS, MICH.—The Holland & Lake Michigan Railway Company contemplates an extension of its line from Holland to Grand Rapids. The company now operates seven miles of track between Holland and Lake Michigan. Mr. C. M. Humphrey is president.

LOGANSPORT, IND.—The Logansport, Rochester & Northern Traction Company has been organized, with a capital stock of $100,000 to operate a line through Logansport, Rochester, Warsaw, Albion and Kendallville. The incorporators are J. E. Beyer, Rochester, Ind., and J. D. Widaman, Warsaw, Ind.

NEW YORK, N. Y.—The Metropolitan Street Railway Company has made arrangements for the extension of the tracks of the Fourth Avenue electric conduit road from Centre Street to the Post Office. This is rendered possible by the recent amicable agreement between the Metropolitan and Third Avenue Railway Company.

CHATTANOOGA, TENN.—The Frank S. Hambleton syndicate, of Baltimore, Md., which recently purchased the several railway properties in Chattanooga, will erect a central power station, to cost $500,000. The Chattanooga & Lookout Mountain steam road will also be converted into an electric line. This road is 10 miles in length.

ALBANY, N. Y.—Catskill Mountain Electric Company has been organized to furnish light for the villages of Pine Hill, Griffin's Corners, Fleischmanns, Arkville, Margaretville and Arena, in the counties of Ulster and Delaware; capital, $100,000. Directors—John M. Blish, George H. Lasher, Charles C. Kaufmann and Andrew J. Kaufmann.

COLUMBUS, OHIO.—The Columbus & Delaware Traction Company has been incorporated, with a capital stock of $5000. The company is organized to build and operate an electric railway through Franklin and Delaware counties with termini at Columbus and Delaware. The incorporators are J. A. Mehling, H. A. Toland, A. T. Seymour, D. T. Keating and S. W. Hubbard.

COLUMBUS, OHIO.—Articles for the consolidation of the Akron Traction & Electric Company and the Akron, Bedford & Cleveland Railway Company have been filed with the Secretary of State and the two lines will hereafter be operated under the name of the Northern Ohio Traction Company. The capital stock of the new company is $3,000,000, of which $1,000,000 is preferred and $2,000,000 common stock.

WASHINGTON, D. C.—The Attorney General has rendered an opinion, in which he holds in effect that the Havana street railway franchise, known as the Torreo concession, on the evidence submitted, is superior to all others and is such as to entitle its owners to be permitted at their own risk, under the permission of the municipal authorities, to proceed with the work of construction without the injunction of the military authorities.

BAY CITY, MICH.—Mr. Michael T. Heraty, of Philadelphia, and John C. Wheadock, of Bay City, have been appointed receivers of the Bay Cities Consolidated Street Railway Company. The petition was presented by the Philadelphia Securities Company, trustee for the stockholders, who are the bondholders also. The receivers are empowered to go ahead with all the contemplated improvements and put the system in a first class condition.

WESTCHESTER, PA.—The Board of Directors of the Philadelphia & Westchester Traction Company has recommended an increase of the capital stock from $400,000 to $1,000,000, for the purpose of extending its line. When the extensions are completed the railway will pass through more than forty miles of a thickly populated section of Chester and Delaware counties. Twenty-two miles of this line are already built between Philadelphia and Westchester. The proposed extension passes out to the valley on Brandywine Creek, northward to Downington and then to Coatesville.

PLAINFIELD, N. J.—The long-drawn-out fight between the Plainfield Street Railway Company and the Brunswick Traction Company, in which the former declined to enter into an arrangement whereby transfers can be issued to passengers between Plainfield and Dunellen, N. J., thus compelling the Brunswick company to violate its terms in Dunellen, was ended at a mass-meeting of the Dunellen people on the night of July 21, when the Plainfield company announced that hereafter they would issue transfers to passengers good on the Brunswick company's lines in Dunellen.

GALENA, KAN.—The Southwestern Missouri Electric Railway Company, which runs from Galena to Carthage, Mo., will spend $200,000 in extensive improvements, such as double-tracking some of the line and constructing a new line from this city to Riceville, Kan. New cars are being built for the company by the Laclede Car Company, of St. Louis. The power house at Webb City will be enlarged and new ones will be constructed at Carthage, Joplin and Galena. New car shops will be built at Webb City and Galena. With these extensions and improvements the road will be one of the finest systems in the southwest.

DETROIT, MICH.—Straight five-cent fares were on July 21 re-established on the old street-car lies, excepting during the morning and evening hours, in which workingmen's tickets are sold at eight for a quarter. The universal-transfer privilege between all lines of all companies, which was begun during the three-cent régime, still continues. An effect of the raise was to divert travel to the newer lines, operated under an eight-for-a-quarter franchise. The City Council, in special session, on July 22, adopted a resolution declaring that the increasing of street railway fares to five cents straight was an unwarranted act of bad faith and a violation of law. The city's legal department was directed to begin legal proceedings against the companies to test the legality of the increase. Proceedings were also authorized to enjoin carrying of freight over the street car tracks and to determine the legality of the present "working" combination of the companies.

THE AUTOMOBILE.

NEW AUTOMOBILE FACTORY.—Howard H. Brown and S. F. Kuhl, of New York, have purchased the plant of the Elgin Sewing Machine & Bicycle Company, at Elgin, and will engage in the manufacture of automobiles. It is stated that the company has an order for 1000 automobiles for use on the boulevards of Chicago.

MORRISTOWN, N. J.—In view of the fact that wealthy residents of Morristown object to the chartering of a proposed trolley line to run toward New York, it is proposed that the Morris County Traction Company, which has a capital of $250,000, ask the Board of Chosen Freeholders to grant a charter for a line of automobiles.

THE STANDARD MOTOR CARRIAGE COMPANY has been organized in Portland, Me., for the purpose of manufacturing, buying and selling all kinds of motor carriages, dynamos, etc. The capital stock is $500,000. The officers are: President, C. G. Whitcomb, of South Braintree, Mass.; treasurer, F. H. Bates, of Hyde Park, Mass.

CURRENT FOR AUTOMOBILES.—Propositions looking toward the use of the Standard Electric Company's current from Blue Lakes City, Cal., for automobiles have been received in San Francisco from several Eastern companies. Electric power for charging would be required along both sides of San Francisco Bay as far south as San Jose.

THE WILLOUGHBY-OWEN COMPANY, of Utica, N. Y., has received an order from the Electric Vehicle Company, of New York, for the manufacture of $60,000 worth of automobile carriage bodies. The order is a duplicate of the one given to the same company by the Electric Vehicle Company last spring. The first order is being rapidly filled at the factory in East Utica.

AUTOMOBILE FACTORY.—It is stated that the Geneva Wagon Company has decided to go into the manufacture of horseless vehicles. A contract has been let for an extension of the present factory. The company will make the body of the carriages, the New York Central Iron Works will supply the iron work, while the motor apparatus will be supplied by the company controlling the patents.

THE COLUMBIA MOTOR & MANUFACTURING COMPANY has been organized at Alexandria, Va., with a capital stock of $5,000,000. The company is obtaining patents for the construction of motors and vehicles for transportation by the use of power. The names of the incorporators are: T. J. King, A. O. Badendreier, T. Downey, of Washington, D. C.; J. R. Caton, of Alexandria, and W. H. Schrom, of Branchville.

AUTOMOBILES IN THE MAIL SERVICE.—It is stated that the Post Office Department will ask for an appropriation during the next session of Congress for the use of automobiles in collecting the mails at all first-class post offices. The purpose is to ask permission to use the appropriation of $410,000 for horse hire allowance. The recent tests in Buffalo have, it is stated, satisfied the officials here that the automobile may be used to advantage.

AUTOMOBILE EXPRESS WAGONS.—The United States Express Company, of which Senator T. C. Platt is president, had an automobile express wagon built some time ago, and recently sent it to Baltimore. It has done satisfactory work, and is to be brought to New York for a trial. It is about the size of an ordinary express wagon, can carry 1000 pounds dead weight, and travels as a rule eight or ten miles an hour. The wagon is worth not far from $2000.

AUTOMOBILES IN ST. LOUIS.—The Mississippi Valley Automobile Transportation Company, which was incorporated recently under the laws of Illinois, with a capital of $500,000, will soon conduct a general transportation business with electric automobiles. They will haul passengers and deliver packages. A cab business will be started by October 1. The incorporators are: George D. Rosenthal, St. Louis, agent for the General Electric Company; Herbert A. Wagner, general superintendent of the Missouri-Edison Company, and F. W. Abbott, and H. R. Gamble, of the Abbott-Gamble Construction Company.

AMPHIBIOUS AUTOMOBILES.—An eastern daily describes an alleged invention which is to enable an automobile to travel over water as well as on land. The invention consists of a catamaran provided with a propeller, which is driven by the vehicle motors. When the vehicle runs on to the boat the motors are connected with the propeller through the medium of gears and sprocket chains. The catamaran thus becomes a sort of ferry. It is evident, however, that it has no propelling power of its own, but depends upon that of its load to drive it through the water. The idea seems to be practicable at least.

PERSONAL.

PRESIDENT HUDSON, of the American Bell Telephone Company, leaves this week for a European trip of about one month.

MR. A. A. GLAZIER, who is not unknown in General Electric and other electrical interests, is the president of the new Central Oil Company, operating in West Virginia, Ohio and Indiana.

MR. C. E. WOODS, designer of the Woods electric vehicles of the Fischer Equipment Company, has been in the East recently. It is said that his company is organizing under powerful auspices to take a very active part in automobile work on a large scale in the near future.

MR. GEORGE E. TRUESDELL, a prominent resident of the District of Columbia, who has long been identified with electric street railway work, has been elected president of the new Washington Traction Company, which controls the lighting and street railways in the District of Columbia.

MR. F. E. DRAKE, commissioner for the United States to the Paris Exposition of 1900, for the departments of electricity and machinery, sailed for France on July 26, to be gone five or six weeks. Several important matters await his attention in Paris connected with the American exhibits and their arrangement.

MR. PHILIP DAWSON and wife left last week on the German steamer Trave for England, after a long stay in this country, where Mr. Dawson devoted much of his time to a close study of the electric railway situation. He has been much gratified at the reception accorded here to his book on electric railways.

WOODBRIDGE—HOTCHKISS.—Mr. J. E. Woodbridge, formerly editor of the *Electrical World*, and now editor of the *American Electrician*, was married on July 25, at Grace Church, New York City, to Miss Ethel Hotchkiss, daughter of Mr. and Mrs. J. F. Hotchkiss. His associates and a large circle of friends in the electrical profession and industry extend their warmest congratulations and best wishes.

MR. J. B. O'HARA, so long and well known in electrical circles as the managing editor of the *Western Electrician*, has resigned that position to become editor of *Modern Machinery*, a Chicago technical monthly. He will be succeeded by Mr. W. E. Keily, for eight years past his associate editor. On the occasion of his retirement, Mr. O'Hara was presented by Mr. Kreidler and a number of past and present members of the staff with a set of handsome books, as a mark of esteem. Mr. O'Hara takes with him from the electrical field the good wishes of a host of friends who have learned to appreciate him and his work.

Trade and Industrial Notes.

THE MAINTENANCE COMPANY, of 220 Broadway, New York, which examines and maintains electrical plants by contract, has recently been issuing a neat desk souvenir to its friends and patrons.

INTERNATIONAL PUMP COMPANY has declared a quarterly dividend on preferred stock at the rate of 6 per cent. per annum. It is said to be earning, above that, 6 to 8 per cent. on the common stock.

AMERICAN ELECTRICAL DIRECTORY of central lighting stations for the second quarter is out and is more valuable and useful than ever. The data is right up to the hour, and as it undergoes constant revision can be depended upon.

THE CENTRAL ELECTRIC COMPANY, CHICAGO, states that it is gaining many new customers for electric railway supplies. It is selling agents for the complete line of railway material made by the Central Union Brass Company, of St. Louis.

MESSRS. ALBERT PRESTON and Louis H. Cohen, of the firm of Preston, Cohen & Company, 1004 Real Estate Trust Building, Philadelphia, were in New York recently preparing to place some large orders for railway material, for which they have numerous contracts.

WESTINGHOUSE PAMPHLETS.—Three pamphlets have just been issued by the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., on the Westinghouse alternating current fan motor, the Westinghouse direct current fan motor and Wurts non-arcing lightning arresters.

THE COLUMBIA INCANDESCENT LAMP COMPANY, St. Louis, Mo., has opened a branch office at 295 Syndicate Arcade, Minneapolis, Minn., and placed it in charge of Mr. Guy V. Williams. The company's business in Minnesota and the North generally rendered this step necessary.

THE FOWLER SWITCHBOARD & TELEPHONE COMPANY, New York, will be dissolved on an order granted by Judge Bischoff, of the Supreme Court, in proceedings for the voluntary dissolution of the corporation which were begun in January last. It is stated that the company is solvent and that all its debts have been paid.

THE HOLMES FIBRE-GRAPHITE MANUFACTURING COMPANY, Philadelphia, Pa., has moved to a more commodious factory building at 5155 Wakefield Street, Germantown, Philadelphia. Modern machinery will be introduced in all departments to enable the company to more satisfactorily meet the growing demand for fibre-graphite.

THE A. B. PITKIN MACHINERY COMPANY, Providence, R. I., announces that it recently acquired the records, drawings, patterns and parts, finished and unfinished, of the Armington & Sims engines, and is completing arrangements which will enable it to give prompt and careful attention to orders for any parts of these engines.

"BRAZING BY IMMERSION," is the title of a 40-page pamphlet issued by the Joseph Dixon Crucible Company, Jersey City, N. J. It points out the advantages of brazing bicycle frames by the immersion process. Dixon crucibles and Dixon's anti-flux brazing graphite are particularly recommended for this work. The pamphlet is liberally illustrated.

MR. CHARLES J. BOGUE, 209 Centre Street, New York, has just installed one of his 26-inch iron marine projectors on the top of the chutes at North Beach, Long Island, for the Bowery Bay Electric Light Company. It is stated that the Bogue searchlights are meeting with special favor amongst yachts and coast vessels. Many of them are also being adapted for advertising purposes.

THE UNIVERSITY OF NOTRE DAME.—Those who may have occasion to look up a college for their sons during the coming year would do well to correspond with the president of Notre Dame University, Notre Dame, Ind., who will send a catalogue as well as all particulars regarding terms, courses of studies, etc. This university is one of the best known educational institutions in the west.

THE ELECTRIC APPLIANCE COMPANY, 92 West Van Buren Street, Chicago, has recently added to its cross-arm factory a complete plant for the manufacture of pins and brackets, and is now turning out this material at the rate of many thousand a day. It is giving special attention to the use of the best material in these goods, and is turning them out with great care so that each piece is as nearly perfect as it is possible to make it.

MR. ALLEN R. FOOTE has begun the publication in Chicago of an interesting economic weekly called "The Other Side," devoted largely to the discussion of municipal ownership and allied topics, and advocating the desirability of a limitation of government or municipal investment in, or operation of lighting plants, railways, etc. It is useful and should be well supported. The price is $2 yearly, and the offices are at 126-132 Market street, Chicago.

THE B. F. STURTEVANT COMPANY, Boston, Mass., has issued an attractively gotten up pamphlet, entitled "2500 Witnesses," being a list of buildings and sundry steamships wherein the Sturtevant system of apparatus has been installed for the purpose of ventilation and heating. The pamphlet has 54 pages, 43 of which are entirely taken up with the list. It shows that Sturtevant ventilating and heating apparatus has a very wide and extensive use. The field is not confined to our own country, but extends into foreign lands.

MESSRS. GATES & RANDOLPH, 13 Monadnock Building, Chicago, Ill., have just issued a pamphlet which covers the apparatus of the various concerns represented by this firm. It contains illustrations and points out the special features of Triumph motors and generators, Warren induction alternators, Empire electrical instruments, Scheeffer transformers, Diamond wattmeters, Ideal circuit breakers, Victor circuit breakers, Sterling arc lamps and Bristol recording volt, ampere and wattmeters and gauges for alternating and direct current.

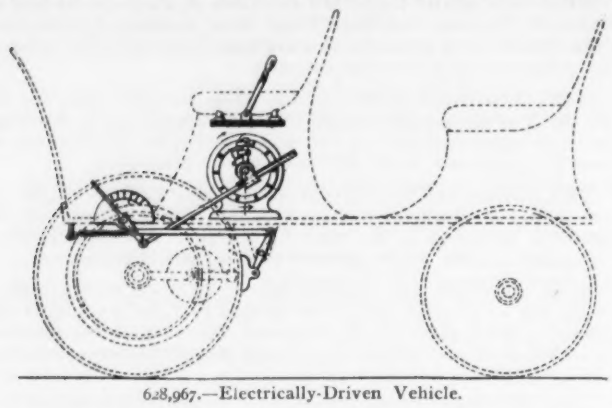
D. M. STEWARD MANUFACTURING COMPANY, of Chattanooga, Tenn., report great activity in all their lines of lava insulators, parts and pieces, and invite inquiries on the subject. These lava goods are now well known to all old-timers for their standard qualities in resisting heat, etc., and are in widespread use. Mr. Steward has of late taken deep interest in the production of calcium carbide by electricity, and to his long line of specialties for gas tips has now added his "Wonder Burner," for acetylene gas, a patent on it being issued to him this week. A little cut of it is shown herewith It is made of the Steward material, and has a cup-shaped cavity for mixing air with the gas before combustion. The results are very satisfactory. The company's New York office, in charge of Mr. Robert Bruce Steward, is at 107 Chambers Street, where the head of the concern is expected before the end of the month.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED JULY 18, 1899.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

628,957. ELECTRIC TRANSFORMER; James W. Packard, Warren, Ohio. App. filed April 22, 1899. A transformer with ventilating openings in its top and bottom, and a shield or baffle plate supported from the casing in a



628,967.—Electrically-Driven Vehicle.

position below the bottom ventilating opening; the arrangement described permits the heated air to pass directly out and prevents the entrance of rain or moisture without the use of circuitous passages.

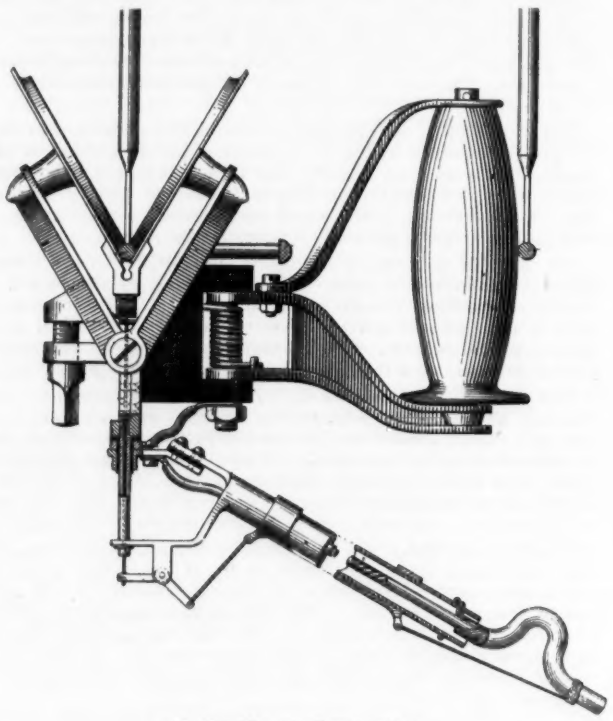
628,967. ELECTRICALLY DRIVEN VEHICLE; H. Van Hoevenbergh, of New York, N. Y. App. filed June 2, 1897. A foot lever is operated to first slow down, and then cut out the motor and thereafter apply the friction brake.

628,968. ELECTRIC LOCOMOTION; H. Van Hoevenbergh, of New York, N. Y. App. filed Aug. 31, 1897. A trolley adapted for motor-carriages and connected therewith through a flexible cord, which will set a brake to slow up the trolley when the flexible cord becomes slack.

628,973. MANUFACTURE OF INCANDESCENT LAMPS; Adolphe Wierre, Paris, France. App. filed March 16, 1898. (See Current News and Notes.)

628,982. CIGAR LIGHTER; A. C. Gruhlke, Waterloo, Ind. App. filed Jan. 6, 1899. The sparking terminals are located in a small chamber containing a charge of hydrocarbon vapor and the motion of the lighter in carrying it to the end of the cigar causes the spark, which, in turn, ignites the vapor and the flame is communicated to the wick.

628,990. KEY SOCKET; C. G. Perkins, Hartford, Conn., assignor to the



623,968.—Electric Locomotion.

Perkins Electric Switch Manufacturing Company, same place. App. filed Feb. 13, 1899. (See Current News and Notes.)

628,994. AUTOMATIC CARRIER FOR ELECTRIC WIRES; F. T. Schottle and H. C. Willitz, of Sheboygan, Wis. App. filed March 3, 1899. The carrier contains a spring motor driving a friction wheel, which bears against the under side of the wire and is held in such position by other wheels bearing upon the top of the wire. The rotation of the friction wheel causes the carrier to move along the wire.

629,058. TELEPHONE HOLDER; M. Mohlgemuth, Detroit, Mich. App. filed April 19, 1899. A specialty constructed arm for holding the receiver and switching it into and out of circuit.

629,130. ELECTRICAL MEASURING INSTRUMENT; E. W. Jewell, Chicago, Ill. App. filed May 18, 1899. The dial plate is mounted to rotate independently of the main case which carries the magnet and other parts of the instrument, the object being to make it possible to adjust the dial to bring the zero point opposite the index.

629,153. ELECTRIC HOLDER; M. W. Dewey, of Syracuse, N. Y. App. filed April 24, 1895. The resistance is in the form of a spiral and is enclosed between two insulating plates which are formed with oppositely placed grooves in which the spiral is located.

629,163. TELEPHONE SYSTEM; R. J. Hewitt, St. Louis, Mo. App. filed April 8, 1898. Each subscriber's station is furnished with two calling devices of different characters, located respectively in the two sides of the circuit and the central office is fitted with a corresponding device adapted to connect with either side of the circuit.

629,198. INCANDESCENT LAMP; Andrew H. Miller, Central City, Colo., assignor to the Miller Improved Incandescent Lamp Company, Denver, Colo. App. filed Sept. 22, 1898. (See Current News and Notes.)

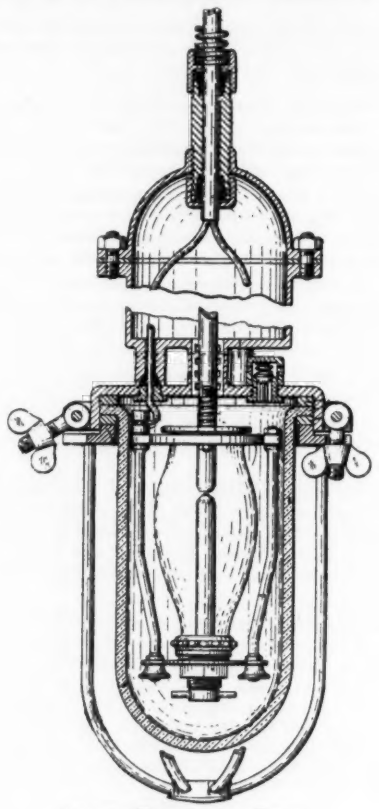
629,201. MEANS FOR PREVENTING SPARKING WHEN MAKING AND BREAKING ELECTRIC CIRCUITS; Adolph Müller, Hagen, Germany App. filed July 13, 1898. (See Current News and Notes.)

629,211. ELECTRIC RAILWAY; C. Russell and A. C. Welchaus, Lancaster Pa. App. filed Aug. 2, 1898. Details of construction with reference to the mounting of the third rail.

629,260. ELECTRODE FOR STORAGE BATTERIES; Charles W. Kennedy, Rutledge, Pa., assignor to the Electric Power Development Company. App. filed April 30, 1898. (See Current News and Notes.)

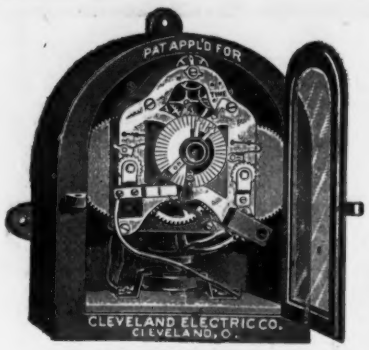
629,291. ELECTRIC ARC LAMP; F. G. Hall, Jr., and I. E. Burdick, Danville, N. Y. App. filed Oct. 6, 1898. A lamp adapted for submarine lighting, the enclosing case being in two parts, one forming the combustion chamber and the other the mechanism chamber; these parts are separated by hollow columns through which one of the electrodes passes.

629,298. ELECTRICAL SIGNALING APPARATUS; C. E. Kells, Jr., New Orleans, La. App. filed Oct. 15, 1898. Comprises a magneto generator and signaling circuit connecting the magneto with a distant station, a signal bell included in the circuit when the magneto is at rest, devices within the handle of the magneto for cutting out the signal bell from the circuit whenever the magneto is operated to send a signal to a distant station.



629,291.—Electric Arc Lamp.

629,302. APPARATUS FOR OPERATING ELECTRIC SIGNALS FOR ELEVATORS; H. Pedersen, New York, N. Y. App. filed Feb. 11, 1899. The signal indicates to the elevator man the presence of an intending passenger at any landing. The passenger pushes a button at the landing and thereby sets one of a series of contacts moving at a slow speed, but proportionate to the speed of the elevator. The selected contact makes connection with a fixed contact in the shaft and gives a signal to the elevator man at the proper time.



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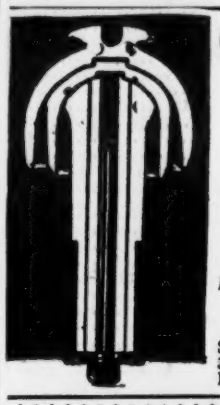

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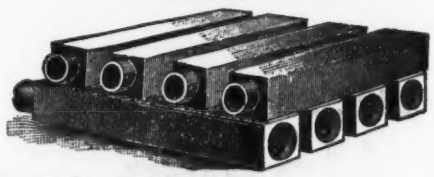

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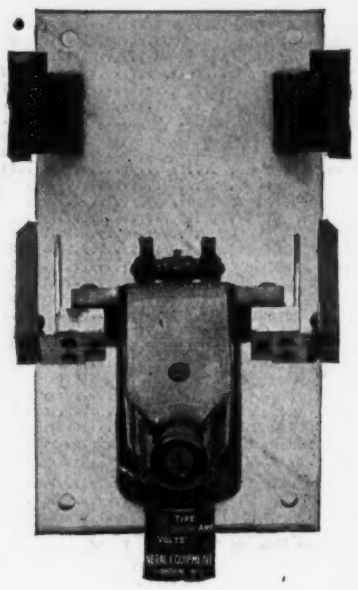

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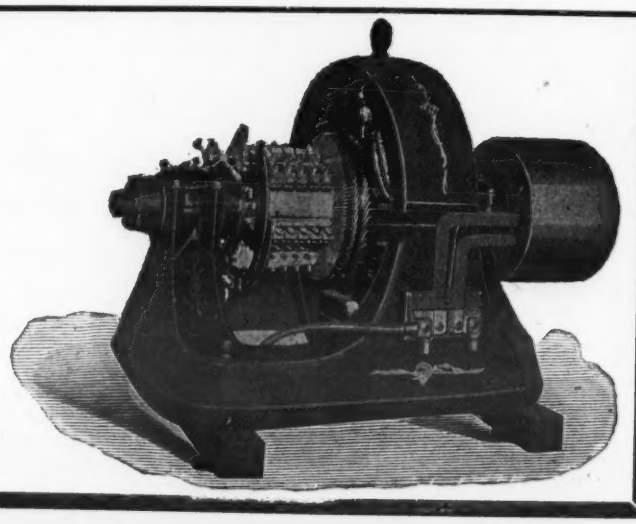

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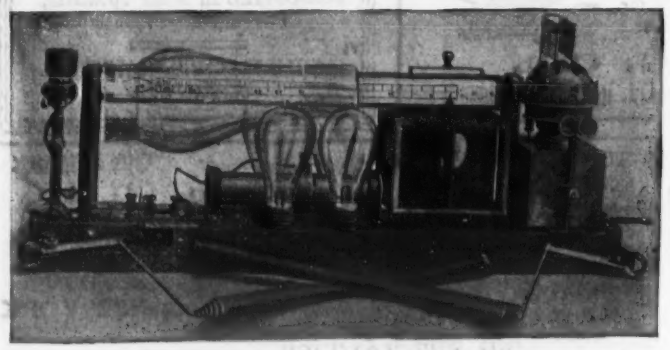

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